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RADIUM THERAPY.

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Two astonishing discoveries have been made within the past twenty-five years in the fields of diagnosis and therapy which the most gifted prophetic insight could never by any possibility have anticipated. How often one is asked, "What is to be the next great step in advance in medicine?" And yet who would dare hazard a surmise with the history of the discovery of the *x*-ray and of radium just back of us.

Moreover I am also sure that, had it been possible for some superhuman doctor sixty years ago to foresee each step of the marvelous progress which has resulted from Listerism, and from serum therapy, his explanations would have seemed like idle tales even to the most astute minds of his generation; they would have fallen on deaf ears and would soon have been forgotten as a foolish romance.

I do not have to go back further than the year 1880, when the class in the University of Pennsylvania, in which I started to study medicine was graduated, to recall my own obtuseness in the matter. Frank Hughes, of Newburn, N. C., was graduated with a thesis on the "Germ Theory of Disease," and I well recall my comment on the utter foolishness of his wasted effort in proving that germs and disease were akin or mutually dependent. He, however, was a prophet on the mountain tops while I was still blundering blindly in the mists of the valley.

And yet radium, that still inexplicable miracle, is actually here working its marvels every day and assuming its established place in medicine, as evidenced by the fact that clinics all over this country, and out of it, are buying their large supplies, and individual doctors are purchasing ten, fifty or one hundred milligrams. I have just received a large sum, to purchase and forward radium to a clinic in India!

My own work in this field began eleven and one-half years ago, and the first successful recurrent uterine cancer case in this country was, I believe, one of my patients, still living in Harrisburg, Pa., upon whom I had operated the previous year for cancer of the cervix. She returned to me for hemorrhages and with a recurrence at the right vaginal vault extending back in the pelvis toward the sacrum. I treated her for twenty-four hours for three successive weeks with a small aluminum tube of radium, and she recovered and has remained well ever since.

From that little beginning, and after the profession had wreaked its vengeance upon me as an innovator, and perhaps one suddenly gone daft, or a quack, the work has grown by leaps and bounds with the years, both in extending and testing radium out in new fields and in acquiring a better knowledge of its technique and methods of application, as well as in learning its serious dangers. In these numerous investigations, taxing all our energies in the fields of invention and application, I have worked continuously in close cooperation with Dr. Curtis F. Burnam; latterly we have the enthusiasm and valuable aid of Dr. Robert M. Lewis, Dr. William Neill, Jr., who cooperates with me in preparing this brief summary, Dr. Dudley A. Robnett, Dr. Joseph G. O'Brien, as well as the trained technical skill of Walter C. Lantsberry, managing the physical investigations, which includes measuring and standardizing the radium tubes, and making the solutions and the pumping of the emanation, or active radium gas, which is transferred to minute glass tubes preparatory to using it in treating the patients.

Since I began this work as just intimated, there has obviously taken place a remarkable change in the attitude of the medical profession with regard to radium treatments for malignant and other diseases, and we have no longer cause to complain of lack of cooperation. In but one particular might the profession be yet more actively with us, and that is in referring cases of Hodgkins disease, and of leukemias, and of the various blood dyscrasias associated with enlarged spleen, for prompt massive radiations in the early stages.

A word as to the methods of application about which there is some confusion of thought: In the first place pure metallic radium has never been seen in this country; one of its bulkier salts or its gaseous emanation is the effective agent always used.

If ten milligrams of radium is bought, what the purchaser really gets is ten milligrams of radium element in the form of the bromide or chloride or sulphate, in a platinum tube—just as though I wanted a grain of the metal sodium and bought the equivalent amount of sodium chloride or common salt instead. All radium purchases should be verified by the U. S. Bureau of Standards. Let me cite three instances as warnings. An English doctor bought some radium from a well-known French firm, and used it over a considerable period, until, satisfied he was not getting results, he determined to sell it, and took it to Sir Ernest Rutherford to be remeasured: Sir Ernest found that the tube for which he was hoping to get some two thousand dollars, did not contain the least particle of radium. This I had from Sir Ernest himself. I, myself, bought, about eight years ago, from the same firm, ten thousand dollars' worth of radium, but when it came to be measured up by Prof. Boltwood, of Yale University, the tubes were found to contain half the amount paid for. Fortunately I was able to compel the thieving firm to make good the loss. How many of their victims have never even suspected the impostors? This very week I had a tube purporting to contain one milligram of radium put into my hands, purchased by a poor man in the hope of benefiting his wife, who had an extensive recurrent cancer of the breast. It came from one of the best known and most reputable drug firms in this country, which had, I believe, bought and accepted it on the reputation of a French firm. When I compared the contents with a U. S. Government standardizing tube which we have, it was found to contain just about one-third of a milligram of radium, and worth at the maximum market price not over $33. A word to the wise is sufficient!

We are sure after a large experience that larger quantities of radium are usually more effective, and so use from one-half a gram to a gram and even much larger doses. In this way we can also treat cases that cannot be touched with lesser amounts. I often use the simile of putting out a fire: A little bit of water will only put out a little fire and is useless for a big raging fire; so a little radium will put out a small area of disease.

As to the method of application; if I want to apply a gram of radium, say inside the uterus, its very bulk in the form of radium salts is a hindrance, so for reasons of convenience as well as security against loss, it is better, when there is enough available to justify the expense of employing a technician, to dissolve all the radium salt in a weak acid solution in a closed glass receptacle; from this its active gaseous principle, called "emanation" by Rutherford is pumped off day by day, with a mercury pump and conveyed to a minute capillary glass tube, which is then sealed and cut off and then taken to the patient's bedside to be used. The greater convenience of this method of application will be seen when I state that all of

Fig. 1. No. 1897.—Patient 59 years old. First seen September 7, 1915. General glandular involvement, all superficial glands being affected, including spleen and mediastinal glands. Note masses in right and left neck.

Fig. 2. No. 1897.—This patient received three massive treatments with radium given over all glandular areas of the body, including abdomen, spleen and mediastinum. Following this there was a complete disappearance of the trouble. This picture was taken October 1, 1915. The patient remains well today and was seen a few weeks ago.

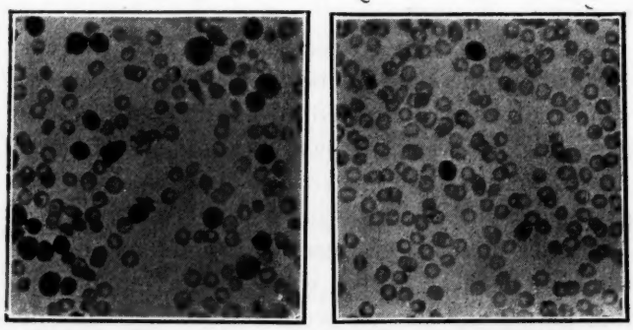


Fig. 3. No. 2194.—Patient 63 years of age. First seen October 3, 1915. Diagnosis: Myelogenous leukemia. W. B. C. numbered 717,600. General glandular enlargement, and spleen reached 3 finger breadths below costal margin. Note the extraordinary blood picture; the large cells, the myelocytes remarkably increased; the small dark cells, the lymphocytes also greatly increased. The pale cells are the red blood corpuscles.

Fig. 4. No. 2194. He received five treatments, the last one June 15, 1916. From 2 to 3 grams of radium used each treatment, covering his whole glandular system and especially the spleen. The white blood cells were 9,300, January 18, 1916. Note above the normal blood picture. This patient is still living but has a recurrence.

the active material of a whole gram of radium in the form of a salt (which itself would fill a small teaspoon) can thus be accumulated in a tiny intensely active glass button not as large as the head of a common pin.

The difference between using the radium salt itself and using the emanation, its active secretion, is much like the delivery of cow's milk; in old times

the cow was often taken from door to door and milked at each stand, in modern times the milking is done out in the country, where the cows are kept in a barn and the milk only is brought to town; the radium is the cow and the emanation is the milk.

Another use that can be made of the emanation, which is of extraordinary value, is by planting it in the tissues permanently in minute capillary glass tubes, each containing from two to three or five millecuries of the gas. A resistent affected gland

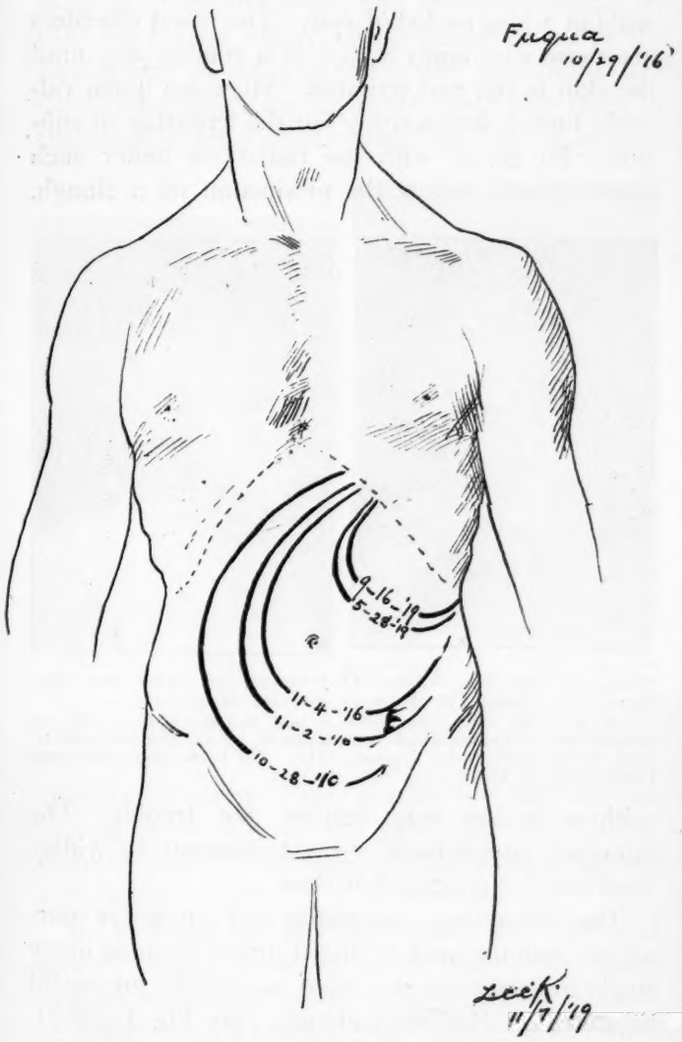


Fig. 5. No. 2888. Patient 39 years of age. First seen October 28, 1916. Diagnosis: Splenomyelogenous leukemia. Gigantic spleen, cachexia. W. B. C. 160,000. First treated October 29, 1916. Has been under observation ever since and has received many treatments. W. B. C. January 15, 1919, 9,500. Reductions of spleen noted on sketch! Has been symptomatically well since December 5, 1918. This is one of the most remarkable cases we have seen.

will sometimes melt down with great rapidity when treated in this way.

A most important factor in any successful treatment is the hearty cooperation of the patient. It almost invariably takes time, sometimes several weeks, often when duty and the heart strings are pulling strongly in the homeward direction. When a man's business seems liable to suffer from his absence, or when a woman feels uncertain about the care her children are receiving at home, it is often difficult to hold them in order to give the necessary treatments, distributed over a sufficient length of time. Still more difficult is it to persuade

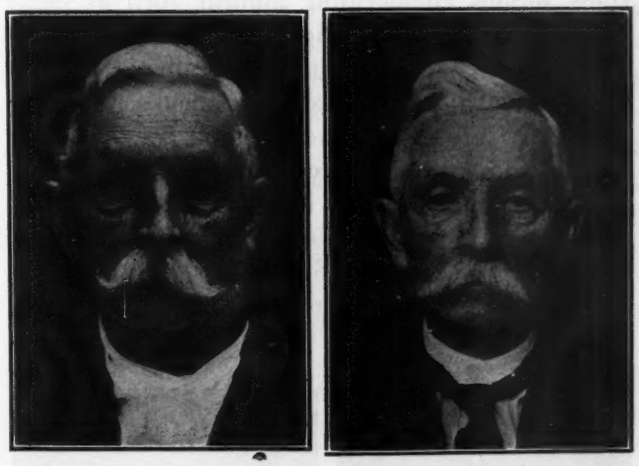


Fig. 6. No. 320.—Patient 71 years of age. First seen October 11, 1913, complaining of a lump in the left side of his neck. Diagnosis; Lymphosarcoma. He received one treatment of 734 mm. of radium for 24 hours. No other treatment. Photograph taken October 10, 1913. Note the large swollen mass of glands on the left side of neck.

Fig. 7. No. 320.—Photograph January 10, 1914. All trace of growth disappeared and there never has been any recurrence and he remains in good health.

a certain number to return as a prophylactic measure when, as far as they themselves can see they are perfectly well. Perhaps the hardest of all are those who "must not upon any account be told that they have a cancer"; they see no reason for any sacrifice of time or inclination and are hard to per-

Fig. 8. No. 767.—Patient 30 years of age. First seen April 17, 1914, with an epithelioma of the inner canthus of the left eye, a common place for its occurrance and one impossible of operation without risking loss of eye.

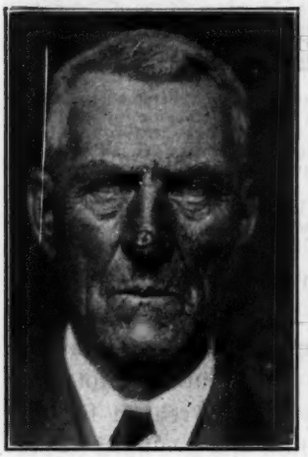
Fig. 9. No. 767.—The result is shown after three treatments with radium. This photograph was taken Nov. 19, 1914. There has been no recurrence since.

suade to remain for the necessary care. The most vexatious patients are those who have an incurable malady and have been for weeks or months under a physician's care and perhaps have had one

or more operations, and yet expect to stop off and be cured with radium between trains.

The most brilliant successes of radium are scored in those fields in which a more aggressive surgical treatment is also usually successful, but where some serious complicating ailment such as heart disease, tuberculosis, Bright's disease or an extreme anemia, contraindicates anesthesia or any procedure which will tax the patient's vital resources. Here radium steps in and does its work quietly and even imperceptibly, and without the slightest risk to life. If it reached no other class at all, our whole outlay of time and expenditure would be more than justified by this group alone.

I purposely present here with some others, also some of our old cases, those which have been



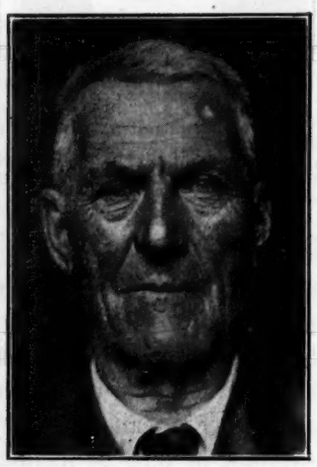


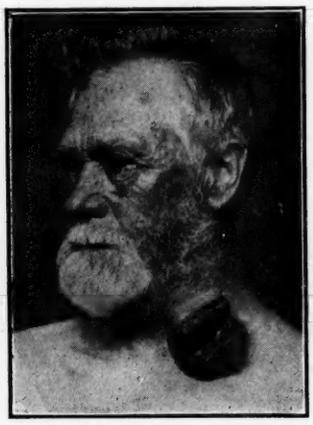
Fig. 10. No. 1699.—Patient 70 years of age. First seen June 4, 1915, with an epithelioma of the nose. Received four treatments, the last one December 18, 1916.

Fig. 11. No. 1699.—Result of treatment over eighteen months later. The growth disappeared promptly but the patient was kept under occasional observation.

shown before, in order to demonstrate more effectively the permanency of the results. I shall show photographs of the following as illustrative cases; of the new field of radium therapy:

1. Hodgkin's Disease—Figs. 1-2.
2. Myelogenous Leukemia—Figs. 3-4.
3. Splenomyelogenous Leukemia—Fig. 5.
4. Lymphosarcoma—Figs. 6-7.
5. Carcinoma of the Inner Canthus—Figs. 8-9.
6. Epithelioma of Nose—Figs. 10-11.
7. Cancer of the Thyroid—Figs. 12-13.
8. Epithelioma of Back of Head—Figs. 14-15.
9. Cancer of the Cervix in three stages—Figs. 16-17-18.
10. Fibroid Tumor Outlined on Gauze—Fig. 19.
11. Mediastinal Sarcoma—Figs. 20-21.

Radium-therapy is coming to be one of the most sharply defined specialties in medicine today. It demands study and experience and a skill in its handling in its various wide fields of application which is not quickly or easily acquired. Great and irreparable harm can be done by overzealous, too intensive and prolonged treatments, when even if the patient escapes serious injury, the tissues surrounding or overlying the part being treated may become so irritated that further treatment has to be suspended indefinitely and a golden chance of curing the disease may be lost. We often receive patients who have had prolonged, trifling, ineffectual applications, just enough to irritate the skin and make it impossible to go on with the use of radium without a long period of rest. The worst offenders are those who apply *x*-rays in a routine way until the skin is red and irritated. Here too much valuable time is lost waiting for the irritation to subside. To go on with the radiations under such circumstances means the production of a slough,



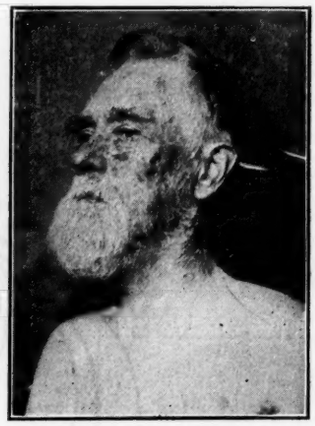


Fig. 12. No. 930.—Patient 73 years of age. First seen June 22, 1914. Diag.: Carcinoma of the thyroid.

Fig. 13. No. 930.—He received one treatment 1911 mgs. of radium for 11 hours, which was followed by complete disappearance of the growth by August, 1914. No recurrence when last heard from in 1918.

without in any way helping the trouble. The spraying, prophylactic *x*-ray treatments so widely used are in our opinion useless.

The interesting, surprising and attractive part of our radium work is that it draws upon so many fields in medicine; we have no other successful treatment of *Hodgkin's disease,* (See Fig. 1 and 2), and here it has succeeded repeatedly, when the patients have been seen early. In *lukemia* (See Figs. 3 and 4) no other remedy is known, and here, too, radium often brings about a remarkable prolonged improvement and sometimes a cure. The various *enlarged spleens* (See Fig. 5) associated with blood dyscrasias are marvellously influenced by radium.

Is Lymphosarcoma (See Figs. 6 and 7) a medical or a surgical ailment? Perhaps the best answer is that it is neither, for neither physician nor surgeon can do the least thing to avert the fatal issue. Radium here often acts like magic. There is nothing

so marvellous, so almost unbelievable, though you are watching the event, as the rapid melting down of a great lymphosarcomatous mass in the throat, which is choking the patient to death one day and a couple of days later is noticably reduced in size, and in a few days more is gone. I show one such case in the figures 6 and 7. Radium therapy draws upon the surgeon, or rather cooperates with the surgeon over pretty much his whole territory, in the field of new growths. It asks him, in the first place, to refrain in the future from futile operations in Hodgkin's cases and lymphosarcoma. It asks for all the superficial epitheliomata about the face where so many unsuccessful operations are done; especially does it concern itself with those in the neighborhood of the eye (See Figs. 8 and 9)

Fig. 14. No. 1365.—Patient 26 years of age. First seen December 19, 1914. Diagnosis: Basal celled carcinoma skin of neck.

Fig. 15. No. 1365—The growth receded rapidly after several treatments with radium and was entirely gone by October 30, 1915. There has been no recurrence and the patient has recently married.

and the nose (See Figs. 10 and 11) and the ear. Cancer of the lip, not too advanced, often yields, while as a rule the enlarged glands are best handled with radical surgery.

On wet mucous surfaces, where the record of general surgery is bad in cancer, radium too meets its most serious difficulties; but the number of cases of cancer of the cheeks, gums and tongue (when seen early) which are being relieved, is *rapidly increasing with experience,* to our great gratification.

A mixed cancer of the thyroid (See Figs. 12 and 13) often does remarkably with radium where there is no hope with surgery; I show such a case in this figure.

Figures 14 and 15 by contrast, recall a most distressing case, indelibly impressed on my memory, from an experience early in my career, back in the eighties, when I was practising in Kensington, Philadelphia: a young woman, a mill worker from near Manayunk, about 19 years old, had just such a lesion and died a miserable death. This patient, on the contrary, owing to the progress made within one generation, is apparently cured and has married since her treatments about four years ago.

What hope is there in the use of radium in cancer of the breast? And what is the best course to pursue in any given case? The decision here involves a fundamental principle in radium-therapy as applied to cancer—namely, *it must be intensive,* it must be a direct application to a given, recognizable lesion, repeated at intervals. It is sufficient to simply spray a lymphosarcoma to dissipate it,

Fig. 16. No. 5015.—Roentgenogram of an enormous cancer of the cervix filling the vagina. This picture was made by mixing a stiff bismuth paste and spreading it all over the surface of the growth with the patient in the knee-breast posture, and then exposing to the *x*-ray. First treatment given April 19, 1919, which 1441 mgs. of radium for 2 hours and 40 minutes.

but spraying will not do for any form of carcinoma, which must be handled with sledge-hammer blows delivered often repeatedly right on the affected spot. The difficulty in a cancer of the breast is this—in an advanced cancer it is manifestly impossible, antecedent to an operation, to know certainly in jnst how many foci the disease is distributed and the attempt to treat indeterminate areas of disease violates the principle enunciated, of repeated intensive treatments to each affected spot.

Let me here enunciate a paradox, which is this, that while all early cases of cancer of the breast are best treated by operation, on the other hand, utterly inoperable cases often improve remarkably under

treatment. I have seen a breast where it was impossible to put the tip of the finger on a sound spot, melt right down and come to appear nearly normal. Unfortunately this does not take care of the metastases. We have adopted the rule in all our breast cases of taking roentgenogram of the chest before operating or radiating. In a large percentage unfortunately we find nodules in the lungs, which as a rule preclude further treatment. I believe that this precaution was first adopted by Dr. Burnam some years ago.

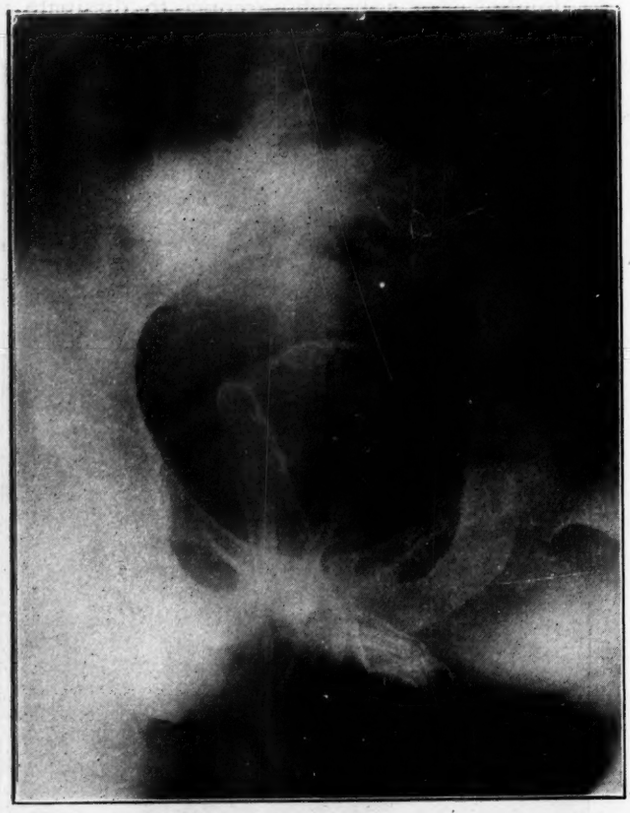


Fig. 17. No. 5015.—Roentgenogram of the same patient as in Fig. 16 on May 10, 1919. The fingers of the examiner have been smeared with bismuth paste and covered with a rubber glove and are seen in the vagina straddling and examining the tumor. The remarkable diminution in size is evident. The second treatment given May 10, 1919, with 961 mgs. radium for one hour.

Cancer of the neck of the uterus (See Figs. 16, 17 and 18) offers the therapist a remarkable opportunity, for the use of radium here bids fair in the near future to drive our surgery entirely out of the field. Let me sketch this matter historically, for it has run a curious gamut. When we first began using radium and found that the big cancers of the cervix, then treated with mesothorium, the equivalent of radium, melted down so remarkably under direct applications at the vaginal vault, a number of surgeons soon ran out before the world, waving their arms frantically like Archimedes of old and shouting, "Eureka! No more surgery; radium cures all these cases; the panacea for cancer is found at last." But the sad experience of many recurring cases began in a couple of years' time to dampen even the ardor of these neophytes, until at last a soberer judgment reigns. The present status of the case seems to be this: In early and very favorable operative cases, operation, preceded by thorough radiation, offers the best chance. Yet even here I am ready to concede that if the patient is near enough to the radium-therapist to be seen at intervals, and will conscientiously keep under observation, radium alone will probably do more than an operation, and without risk or mutilation. I venture to predict that within five years we are

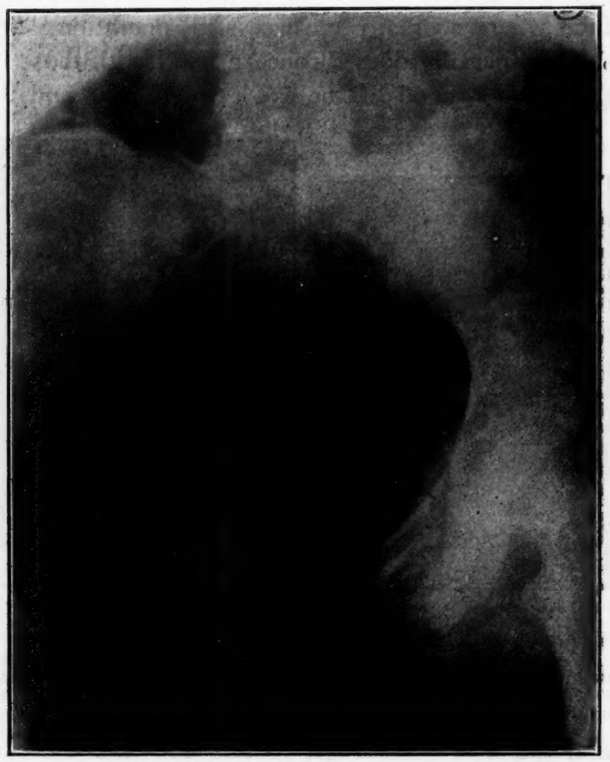


Fig. 18.—No. 5015—Three weeks later roentgenogram of the same case shows the cervix about normal in size. Patient received the following additional treatments, May 31, 1919, 274 mgs. 2 hours; June 21, 1919, 524 mgs. 30 minutes; August 2, 1919, 1460 mgs. 1 hour. Examined early in November I could find no disease, and removing a piece of tissue for microscopic examination this diagnosis was confirmed.

all of us likely to be using radium to the utter exclusion of operations; my dear friend, John Clark, already takes this stand. Now in all other cases except this group most favorable for surgery, that is to say in all in which any lateral fixation or infiltration of the parametria or broad ligament tissues can be felt by a careful rectal examination (made under anesthesia, if necessary) radium will do more for the patient than operation, for here recurrances are almost invariable. In some of these cases, as in masses of disease elsewhere, lingering nodules can often best be treated by the insertion of the minute capillary sealed glass points, each containing from three to five millecuries of emana-

tion (the equivalent strength of the maximum yield of from three to five milligrams of radium) right into the tissues by means of a specially constructed hypodermatic needle. The points are buried and lie innocuous in the tissues, and the emanation sinks to zero in about five days. Such an apparatus has been designed by Dr. Robert M. Lewis to insert these points, or spicules.

A most precious and fruitful field for radium-therapy lies in the recurrent cancers at the vaginal vault. When these are seen early they can often be wiped out, never to recur. All of our uterin cancer patients ought to be examined at regular and fairly frequent intervals in order to detect a relapse at the earliest possible moment, when rad-

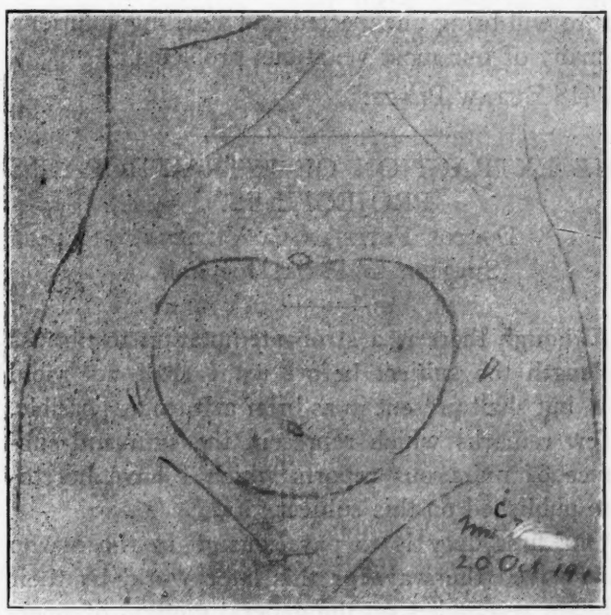


Fig. 19. No. 334.—Patient first seen October 20 1913. Diagnosis: Large myomatous uterus. This is shown as outlined on the abdomen and then transferred with pencil to crinoline laid directly on the abdomen. Treated with 100 mgs. for 24 hours. No further treatment. Complete amenorrhea which has persisted until now. No myomata could be found June 23, 1914. The uterus appears lightly enlarged and lies in the pelvis well behind the symphysis.

ium should be used at once. Here radium is supreme for there is but a small chance with surgery. Massive recurrences are often improved but rarely recover completely.

In "idiopathic," or so-called myopathic bleeding uteri, that is to say in all persistent uterine bleeding without gross demonstrable cause, about the time of the menopause, radium is the one supreme remedy. We used to curette these poor sufferers endlessly without benefit and then, as a last resort, shamefacedly proceeded, with apologies, to remove the uterus; but today, with a single application of radium, presto, all is changed and a cure is effected, without the risks and discomforts of an operation —not to be despised in the condition of extreme anemia often seen in this group.

One of radium's most wonderful fields is the treatment of fibroid uteri; here, perhaps in nineteen out of twenty, we can check the bleeding and stop the growth of the tumor, which shrinks more or less rapidly and sometimes disappears entirely. This, too, may be a matter of one or two brief courses of treatment, external as well as internal.

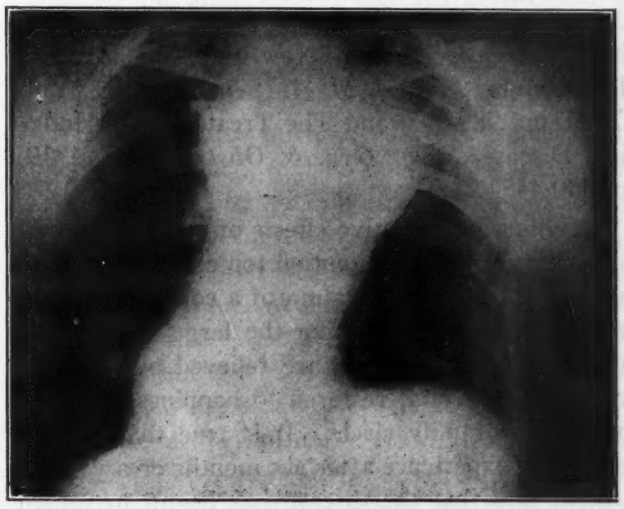


Fig. 20. No. 1965.—Patient 49 years of age. First seen October 11 1915. Diagnosis: Mediastinal sarcoma.

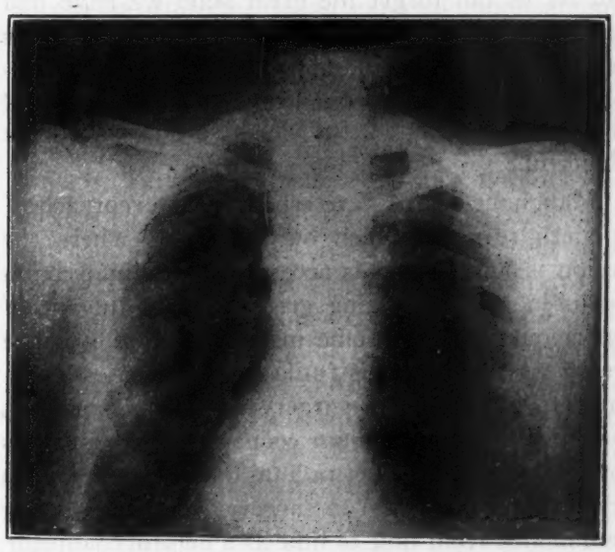


Fig. 21. No. 1965.—He received seven treatments with radium, using from 2 to 3 grams each time. The last treatment May 21, 1917. Note the remarkable disappearance of the tumors from the chest and with their going a progressive diminution of the most distressing sense of choking and dyspnea. There has been no recurrence and he appears well.

I give here a reduced picture (see Fig. 19) transcribed from our hospital records more graphic than verbal description. Let me remark that the size of the tumor does not seem to make much difference and that the treatment can often be given just as effectively through the abdominal walls as within the uterus itself. It is well to warn the patient that the first period may make its appearance and be very free, due doubtless to the increased hyperemia following the radiation.

Space fails me to cover even in outline this large field, but I must at least touch upon the marvellous results in a group of distressing sufferers whom, up to the days of more massive radium-therapy, we were compelled helplessly to watch die a lingering death from the gradual choking of the chest with sarcomatous (see Figs. 20 and 21), or with Hodgkin's enlarged intrathoracic, substernal glands. Dr. C. F. Burman has written at length on this subject, giving our experiences (New Growths of the Mediastinum, *Jour. A. M. A.*, Sept. 22, 1917, Vol. LXIX, pp. 989-995, and The Treatment of Hodgkin's Disease, *Surg., Gyn. & Obstst.*, May, 1919, pp. 440-445).

Touching the palliative effects of radium, I often think that we fix our attention too exclusively upon the natural great desideratum of a complete cure in our cancer cases, forgetting the large and important group of those who are relieved over a long period of time, and restored to happiness and the joys of the family circle. It is true that it is a harrowing experience after six months or a year or two, to find that the disease has begun to return and that it is no longer amenable to our treatment, but let us not forget the great boon we have had in the amount of relief given. Then, too, let us not forget the considerable group in which hemorrhages have been completely checked and foul discharges eliminated, for which so many are most thankful.

Malignant diseases are especially the reproach of modern surgery, which only succeeds where the lesion is limited and is accessible. Radium comes to us in this distressing group as an adjuvant of enormous value, in some instances bringing entire relief where surgery is futile; in a few cases working effectively where surgery also works but less effectively; again radium coöperates with surgery over a large field. Let radium then be looked upon chiefly as a handmaid to surgery, honored in being summoned from time to time as a helpful coadjutor.

Let our last words be these, that in radium therapy as in surgical therapy, two things are of vital importance, first, that the earlier the case is seen the better are the chances of a permanent result; secondly, that every case ought to be followed up carefully at intervals of a few weeks or months, for years. I think he does the best work in this field who commands both resources and can resort with equal facility either to radium or to surgery or can employ both conjointly as seems best. Finally, with this new and astounding radium therapy just domiciled within our therapeutic household we can repeat the words of John Tyndall over a half century ago (1863), in his work on Heat as a Mode of Motion—"Even now we can discern, though but darkly, the greatness of the issues which connect themselves with the progress we have made—issues which were probably beyond the contemplation of those by whose industry and genius the foundations of our present knowledge were laid." No one will dare predict what lies beyond us in the path of therapeutic advance, but it is safe to assume that discoveries do lie before us no less greater than those which have bestrewed our way these last few decades. Let us then, like those intrepid mariners who first turned their faces westward and braved the unploughed wastes of the Atlantic, look with confidence out into the vast and troubled seas of the unknown, assured that the near future will bring unexpected and startling solutions to many of our most vexatious problems.

1418 EUTAW PLACE.

THE EXTRACTION OF INTRA-THORACIC PROJECTILES.

DOCTOR PETIT DE LA VILLEON,
Surgeon to Paris Hospitals.

Although there is a strong temptation to discuss at length the subject before us, I shall not yield to it, but shall present in as brief a form as possible, a few remarks which represent the sum and substance of numerous reports which I have heretofore published on this subject.

Our first duty is to pay homage to those who have paved the way for this later work, by their brilliant researches on the general method of operative extraction of foreign bodies under *x*-ray guidance, particularly Messrs. Wuillamoz, Civel and Mauclaire.

The method which I myself have evolved for the extraction of intra-thoracic projectiles under the fluoroscope by means of forceps, and particularly for intra-pulmonic foreign bodies, requires a technique the description of which I shall not here repeat. I shall recall to you only, that it consists essentially of the following: at the proper chest level a narrow button-hole incision is made through the skin only. A long blunt forceps is passed into this incision, pushed through the chest-wall and the pleura, then, penetrating into the lung, it is carried to the projectile, touches it, mobilizes it, grasps it, and extracts it. A suture closes the incision.

The operation lasts a few minutes, often not more than two or three, and as for the operative reactions, the surgeon is surprised by their extreme simplicity. The simplicity of immediate operative

consequences, the perfection of remote operative results, the complete "restitutio ad integram," are the characteristics of this method.

Statistics.—In support of this technique I present my own statistics. I shall not mention the operations which I have performed since June 1915, by thoraco-pneumotomies according to old or new methods; neither shall I mention the statistics of surgeons who have followed my technique and operated by means of the forceps pushed into the lung, because I have only their incomplete statistics and I feel that they belong to their authors. I shall append, however, to my list, the extractions I have performed from the hilus, the pleura, and the diaphragm.

I have operated under these conditions, up to the present, upon 336 wounded men suffering from war projectiles embedded in the intra-thoracic organs. Amongst these cases, there are 333 cures and 3 deaths, which represents a total mortality of less than 1%—0.89% to be exact. These operations were as follows:

1. Intra-pulmonary projectiles, extracted through a button-hole incision, under the fluoroscope, at a depth varying from 1 to 13 cm. in the parenchyma .....255—Deaths: 3
2. Projectiles in the hilum—hilum method ..... 17 " 0
3. Projectiles in the pleura, extracts through a button-hole incision by means of forceps, under the fluoroscope ..... 48 " 0
4. Projectiles in the diaphragm, various methods ..... 16 " 0

Projectiles extracted from the lung, fluoroscopically have given me in 255 cases, 252 cures and 3 deaths. Twice death was due to the situation of the projectile near the hilus, and was caused by hemorrhage; since the subject succumbed to some immediate accident, whose nature I could not determine, perhaps due to anesthesia; but nevertheless, I shall attribute the death to the operative procedure.

The Surgical Principle.—The forceps extraction under the fluoroscope of intra-pulmonic projectiles, superficial or deep. is based on a principle, supported by research and by numerous reports, which can be formulated thus:

A blunt instrument, introduced slowly into the lung parenchyma, living and healthy, causes no damage, provided that it follows a single tract, and does not penetrate the region of the hilus.

This is the fundamental law on which the method is based, a physiological law never before formulated, and possibly disputed, but which I believe, may be accepted as true. On account of the elastic and resilient consistency of the living and healthy pulmonary, parenchyma, the blood vessels and bronchial structures, which are not attached to anything, nor obstructed by anything, are turned aside by the blunt end of the instrument, and the forceps passes by them.

But, the objection has been offered, that it is necessary for the surgeon to go through a period of training in this method. This is true. I have always maintained, that no operator, however dexterous, should attempt to attack the lung before he has familiarized himself with the general technique of extraction under the fluoroscope, nor before he has extracted several dozen shell fragments from the extremities. But I might add, that after this short apprenticeship, the operation on the lung will be relatively simple.

Because a therapeutic method, which promises absolute relief to the patient, requires an apprenticeship, is no reason to condemn it. For example, should every child who had accidentally swallowed a coin be subjected to an external esophogotomy, because a remarkably simple instrument like that of Kirmisson requires that the surgeon learn how to use it?

The Region of the Hilus.—The method of forceps extraction under the fluoroscope, while serviceable for the lung, and at all depths, presents one contra-indication, (and I cannot repeat it too frequently): This is location in the hilus of the lung, and its immediate large ramifications, which has been termed "the hilus region." In a memoire read before the Société de Chirurgie by J. L. Faure, whom I never can thank sufficiently for his valuable encouragement and kindness, I added an attempt to define the surface and deep limits of this region. It appears less extensive than one might believe; and one might outline the danger zone, in which the forceps removal is contra-indicated, on the human subject, projected onto the posterior wall of the thorax as follows: *"A scapulo-vertebra trapezium limited internally by the spine, externally by the vertebra border of the scapula in its lower half, above by the fifth rib, below by the eighth rib."* Projectiles that throw their shadow in this trapezuim, and situated at a depth of from 6 to 14 centimeters beneath the posterior projection of the shadow, occupy the hilus region forbidden to the forceps.

Up to the present time surgeons have not dared to attack these projectiles in the hilus, but impelled

by the dangers of foreign bodies in this location and the possibility of formidable hemorrhage which might result from them, operators have begun to take courage.

Le Fort and Pierre Duval have had good results with brilliant methods, and for projectiles in this region I myself advise "posterior radio-operative thoracopneumotomy."

The operation may be performed under strong red-orange light, under *x*-rays with the fluoroscopic screen, or by white daylight. Aided by resection of the posterior ribs, and by a total pneumothorax, I enter the hilus from behind forwards complete the extraction, and pack with a deep tampon. The tampon is removed after two or three days, according to the case, always with extreme gentleness. I have thus operated upon 17 such cases, with 17 cures, two of the cases developing empyema.

Objection has been made that pulmonary suture might perhaps be better than packing; the same objection had been made in reference to the other method of extraction by forceps under the fluroscope, that I sacrificed the benefit of pulmonary suture. My reply is that when operating in the region of the hilus as in other portions of the lung, there is, in my opinion, only one safe method of hemostasis for large bleeding vessels, when direct ligation cannot be performed, and that is deep packing. It must not be forgotten that in hemorrhage within the lung, there are two routes of egress for the blood: first, through the pulmonary opening, toward the pleura and chest wall, the exterior route; second, the interior route from the wound through the nearly always present communication with the bronchi trachea and mouth. These two routes are equally wide, and if a large vessel bleeds in a pulmonary wound, and direct ligature cannot be applied, suture of the pulmonary parenchyma affords only an illusory security. Only deep packing, by closing off both avenues of escape, can secure a rational and effective hemostasis. I am not unmindful, too, of the powerful aid to hemostasis which exists in these cases in the total pneumothorax.

PLEURO-DIAPHRAGMATIC PROJECTILES.—In pleural and diaphragmatic situations of projectiles surgery can accomplish the removal, without danger, if the surgeon is eclectic and varies his methods. Extraction with forceps under the fluoroscope through the button-hole incision is admirably adapted to all projectiles in the pleura, excepting only those in the mediastinal pleura. Here, if the surgeon decides to intervene, he should do so only with all resources available for major thoracotomy, according to the method of Delarine, Fontan, Pierre Duval, or le Fort.

At the level of the diaphragm, I have suggested that projectiles be divided into three groups, according to the region which they occupy.

1st group—Projectiles in the right diaphragm.

2nd group—Projectiles in the left diaphragm.

3d group—Projectiles in the median or mediastinal diaphragm.

For the first group, in the right diaphragm, preference should be given to forceps extraction under the fluoroscope; it is the least mutilating and the surest. The proximity of the dome of the liver offers no danger, and I often say "I operate on the liver as on a table."

For the second group, in the left diaphragm, the use of the forceps through a button-hole incision, is imprudent and dangerous, because of the proximity of the abdominal organs (greater curvature of the stomach, splenic flexure of the colon) to which the diaphragm may be adherent as the result of the original injury. These adhesions are very dangerous, and cannot be foreseen. In the situation of the left diaphragm, one must operate "under open skies," by the thoracic or abdominal route. I prefer the abdominal route.

For the third group projectiles lying in the median or mediasterial portion of the diaphragm, forceps extraction under the fluoroscope is definitely contra-indicated, and this method, so useful in other regions, would be blind folly here. By all means, use the open method, by the thoracic or abdominal route, and here too, I personally prefer the abdominal route, arriving at the central diaphragm from below.

SHOULD ALL INTRA-THORACIC FOREIGN BODIES BE OPERATED UPON?—One must weigh the inherent danger of the foreign body left in place, and the inherent danger of the operation for its extraction. In other words, in cases which can be operated upon by the forceps under the fluoroscope, I believe that all projectiles should be removed. In cases that would necessitate thoracopneumotomy or abdominal approach, one must weigh carefully all the circumstances in order to decide whether to operate or not.

WHAT IS THE BEST TIME TO OPERATE?—The results obtained "à froid," that is to say on a cicatrized thorax, at least three weeks after the injury, are so good, that it might seem that this is the best time to operate. However, one must take into account those grave cases in which the primary hemorrhage forces the surgeon to perform early and wide

thoracotomy as has been demonstrated by Pierre Duval.

On the other hand, the expectant method is sound, in large numbers of chest wounds, and excluding imperative conditions which force the surgeon to operate, the wiser method would be to limit the primary operation to the toilet of the chest wall, and of the frequently associated fractured rib, putting off to a later date the extraction of the foreign body, unless it is within immediate reach.

In conclusion, extraction of intra-thoracic foreign bodies has been improved considerably by perfection and simplification of the technique, particularly by the association of the *x*-ray in radio-operative methods.

CONGENITAL AND INFANTILE HERNIA ASSOCIATED WITH UNDESCENDED TESTICLE AND POTENTIAL HYDROCELE.

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There has been a great deal of discussion among surgeons as to just what constitutes a congenital or infantile hernia with its associated abnormalities, such as undescended testicle with or without infantile hydrocele. The literature upon the subject is not, in my opinion, at all comprehensive or explanatory. The cases which have come under my observation have been of definite anatomical types. Personally, I believe that all herniæ are congenital, but so long as the classical literature classifies them as "congenital and acquired," it does not become me to be dogmatic.

DEFINITION—INFANTILE HERNIA.

An infantile hernia is that type of hernia which shows anatomically a distinct obliteration of the funicular process at or near the internal ring, becoming patent external to the ring, and continuing so downward to open into the tunica vaginalis testis. A definite hernial sac is present in most cases, but it may be so thin and undeveloped as to make it impossible to identify it, owing to the associated hydrocele.

One of two conditions is possible:

1. The true hernial sac may become pushed downward behind the hydrocele sac, in which case it is usually very easy to identify and dissection is very simple.

2. It may become invaginated into the hydrocele sac, in which case they are intimately associated and adherent and consequently entail a great deal of patience in dissection.

CONGENITAL HERNIA.

1. A failure of the funicular process to close at the internal ring allowing free passage of fluid and abdominal contents into the cavity of the tunica vaginalis. In this type the patent funicular process forms a sac and is intimately adherent to the structures of the cord. This constitutes a true congenital hernia.

The varieties of cogenital hernia are:

1. Vaginal.
2. Funicular.

In the vaginal variety the sac is continuous with the tunica vaginalis, and the testicle is completely covered by the hernia. In the funicular variety the sac always lies above and is distinct from the tunica vaginalis and the testicle.

THE EMBRYOLOGIC DESCENT OF THE TESTICLE.

The embryologic "mesentery" or peritoneal fold called, in the male, the mesorchium, is more or less a suspensory ligament, diaphragmatic in its upper portion and inguinal below, called the inguinal ligament of the primitive kidney. The inguinal ligament contains between its folds connective tissue and unstriped muscle fibers. These become the gubernaculum testis in the male and the round ligament in the female. At the eighth month it enters the inguinal canal and normally just before birth leaves the inguinal canal and enters the scrotum. The arrest in its progress before it enters the inguinal canal causing it to remain within the abdomen should be designated "abnominal testicle" and the terms monorchism or cryptorchism should be applied to the condition when one or both testicles remain in the abdominal cavity. Developmental defects of the male sexual system embryologically may be the cause of the failure to descend. The secretory part of the testicle, which is derived from the metamorphosis of the indifferent sexual system, may be arrested or abnormal in development. The system of efferent ducts furnished by the Wolffian body may be arrested in development intra-abdominally. One or both of these factors would explain an arrest in descent or in development. The cremasteric muscle and fascia derived from the internal oblique muscle in the descent of the testicle are very thin and undeveloped, and the same is true of the infundibuliform fascia, resembling in some cases little more than a thin veil surrounding the cord. The testicle itself is small, atrophic, and usually hypersensitive. It is in most cases the seat of a partial or complete fibrosis. The spermatic cord is small and shows in some cases the adhesions of old inflammatory processes.

INFANTILE OR POTENTIAL HYDROCELE.

This is present in some degree, in all cases of infantile hernia, and is due to the same causes that operate to produce this type of hernia. The types are:

1. Diffuse hydrocele of the cord.
2. Encysted hydrocele of the cord.
3. Encysted hydrocele of the tunica vaginalis (rare).
4. Encysted hydrocele of the testes or epididymis.
5. Diffuse hydrocele of the cord and testicle.

ETIOLOGY.

1. Developmental defects.
   (a) Failure of the funicular processes to close.
   (b) Late descent of the gubernaculum testis.
   (c) Hereditary weakness of the abdominal wall.
2. Increased intra-abdominal pressure.
   (a) Large internal abdominal ring.
   (b) Relaxation of the lower abdominal wall.
   (c) In association with infantile hernia.

The encysted varieties of hydrocele, which are rarely seen except in infants coexisting with these herniæ may be due to—

1. Infantile hydrocele.
2. Inflamatory processes of the cord or testicle.
3. Traumatism at birth or an injury by a blow or undue pressure upon the scrotum or inguinal canal.
4. Patency of the funicular process at some portion of the cord, being closed at the internal ring and at the tunica vaginalis.

SYMPTOMS.

1. The condition usually is discovered in early adult life.
2. Impulse on coughing may or may not be present.
3. Acute strangulation with signs of obstruction may be the first symptom which calls the attention of the attending physician to the inguinal region in routine examination.
4. The presence of tumor in the groin, reducible or irreducible, should lead one to consider the possibility of congenital or infantile hernia.
5. The presence of fluid in or around the structures of the cord or testicle would suggest the possibility of coexisting hernia and hydrocele.
6. If inflammatory changes have occurred tenderness will be elicited on palpation.
7. The surgeon is usually consulted by the parents in regard to the absence of the testicle in the scrotum with perhaps a tumor in the groin.
8. Oftentimes attention is directed to the condition by the presence of a subacute orchitis of the retained testicle. This may last several days and be associated with slight fever and nausea. This probably is due to some slight traumatism or circulatory changes, as we know that retained testicles are very prone to repeated inflammations and progressive fibrosis.

DIFFERENTIAL DIAGNOSIS.

These combined pathological defects should be differentiated from:

1. Encysted hydrocele existing alone.
   (a) It presents a smooth globular outline.
   (b) It is freely movable in the canal.
   (c) If the testicle is present traction made upon it renders the canal tumor immobile.
   (d) The limitation of the upper end of the swelling is characteristic of hydrocele of the cord.
2. Inguinal adenopathy.
   (a) Usually adherent; impulse on coughing may be transmitted through the enlarged glands though it is not expansile.
   (b) The absence of opening at the internal ring.
   (c) Chronic abscess, which may be secondary to inflammations of the spine, abdominal wall or pelvis, and may point in the inguinal region. The impulse on coughing may also be present here but the indefinite outline would readily distinguish it from hernia.
3. Hematocele of the cord.
   (a) A history of injury.
   (b) Ecchymosis.
   (c) Absence of impulse on coughing.
   (d) Acute pain and perhaps nausea.
4. Undescended testicle.
   (a) Absence from scrotum.
   (b) The presence of a tumor in the canal may or may not be present.
   (c) If present the tumor gives testicular sensation upon pressure, or traction.
   (d) Irreducible.
5. Lymphoma.
   (a) This condition is very rare.
   (b) Large and smooth in outline.
   (c) May be rapid in growth.
6. Tumors of fat, etc.

These fatty tumors may be entirely disregarded, I believe they exist only in the literature.

7. Scrotal types of hernia.

These usually manifest themselves at puberty. They appear suddenly and may become complete at once after some sudden or violent muscular effort. This type may be followed immediately by acute strangulation of the contents and constitute what is known as "acute hernia."

8. Torsion of the spermatic cord.

A great deal of theoretical nonsense has been written about this condition. It is my opinion that torsion of the spermatic cord never occurs except in congenital or infantile hernia of the irreducible type, associated with undescended testicle. It is conceivable that this condition may occur where an undescended testicle lies at the external ring and is freely movable, but not otherwise. Several lengthy, tiresome papers have been written upon the subject of cord torsion, and extensive bibliography quoted, in an attempt to show its frequency. However, the fact remains that a normal testicle and cord imbedded in the dartos of the scrotum and in the inguinal canal does not twist upon itself without a pathologist basis in fact. In G. Frank Lydston's "Genito-Urinary Diseases," he says "up to 1901 there were but 32 cases of torsion of the spermatic cord collected from the literature."

RECURRENCE.

With careful dissection and care in closing the wound recurrences are rare as to the reproduction of the hernia *per se*. The undescended testicle presents the real problem. The number of operations originated by many different men for the relief of this condition is an admission that all of them are only partially successful. In the large complete hernia of these types associated with a small neuralgic testicle I believe unilateral castration with the radical cure of the hernia to be the best and most conservative procedure, especially in view of the fact that these testicles degenerate and ultimatly become sterile. If the testicle is situated at the external ring, is movable, and the cord is easily freed from the surrounding structures of the canal it is comparatively easy to deliver it into the scrotum, and the prognosis is much better than when it happens to lie within the canal or near the internal ring; if the latter is the case it of course would require an altogether different method of procedure.

OPERATION—CONGENITAL HERNIA WITH UNDESCENDED TESTICLE SITUATED AT THE EXTERNAL RING.

The usual hernia incision is made, extending well down over the pubic bone and perhaps one inch into the scrotum. The external oblique fascia is incised and reflected backward. Poupart's ligament is identified by blunt dissection and the conjoined tendon is freed from its underlying structures and the finger passed under it the length of the canal up to the internal ring. The spermatic cord is now freed by careful sharp dissection which should be made without undue tension being placed upon the cord. When the cord is freed up to the internal ring the infundibuliform fascia is completely divided in its entire circumference and separated from its investment of the cord at the internal ring. This I regard as very important inasmuch as it will often give an extra one-half to one inch extension on the cord when traction is made afterward. The identification of the sac is next accomplished by splitting the cremasteric fibers and by blunt dissection. In the vaginal variety the sac is continuous with the tunica vaginalis and the testicle is completely enveloped by the hernia. In the funicular variety the sac is above and is distinct from the tunica vaginalis and the testicle. In both instances, however, the sac is intimately adherent to the cord and requires careful sharp dissection to free it. In the former type the sac may be partially separted from the cord, divided above the testicle, reflected upon it or removed altogether. This step cures the vaginal hydrocele. The sac farther up may be dissected free from the cord or may be treated in the same manner as the part investing the tunica vaginalis. This I believe would be appropriate treatment when encysted hydrocele complicates the hernia. In the latter (funicular) variety where the sac lies above the tunica vaginalis and is distinct from it the identification, separation and removal of the sac is much more easily accomplished than in the former. The sac here may be freed with little difficulty and treated as in ordinary hernia.

UNDESCENDED TESTICLE.

Inasmuch as each case of undescended testicle presents a distinct surgical entity, the technique for its cure must of necessity involve widely different methods of procedure. As previously mentioned, the division of the infundibuliform facia as it invests the cord, when combined with sharp dissection and separation of the cord from surrounding structures in the canal, may produce sufficient relaxation to permit of its delivery into the scrotum without undue trauma or tension. In no case should a cord transplantation be done as this obviously would greatly change the contour of the canal, and consequently shorten the cord in proportion thereto. The Ferguson operation is the one of choice in this condition, in that it replaces the cord in the canal in essentially its former position, and permits of more cord relaxation. If there has been repeated inflammations in or around the cord the adhesions should be separated and contractions removed. If the testicle is situated within or near the internal ring, castration with removal of the cord up to the ring should be performed. This precludes the possibility of malignant degeneration of the testicle which is said to occur in rare

instances, and it also prevents recurrence of the hernia by permitting the complete closure of the internal ring by suture. In some instances it is good surgery to penetrate the floor of the canal one inch below the internal ring and, by completely freeing the cord and testicle, passing it backwards through the internal ring into the abdomen and out again behind and below the epigastric vessels, this new opening to be made through the peritoneum and the triangular fascia of the posterior layer of the abdomen. The old ring may be completely closed adding another inch to the length of the cord by decreasing the length of the inguinal canal. Great care should be taken in this type of operation as the newly constructed ring may constrict the circulation and produce great edema or gangrene of the testicle. The operator should be very cautious in penetrating the canal in this location as the bladder may be present in the wound and may be injured thereby.

Attempt should be made to avoid the epigastric vessels as they cross the canal below and internal to the internal ring. Injury to the ilio-inguinal nerve in the canal and the ilio-hypogastric nerve as it enters the conjoined tendon of the internal oblique and transversalis muscle should be carefully guarded against. The roof of the canal may be closed as in other herniæ, the conjoined tendon sutured to Poupart's ligament without tension with interrupted catgut stitches, and the external oblique fascia closed by continuous suture. The testicle may be anchored to the lower end of the scrotum with catgut, though I believe this has no bearing on the end-result. French authors have advocated the crossing of the testicles in the scrotum through the median partition, but I believe this to be an error in technique as it only increases the tension upon the cord and the end-result is the same or even worse than in the older types of operation.

While stationed at an United States Army Hospital abroad I was fortunate in having assigned to me a large number of hernia operations and was deeply impressed with the large per cent. of Acute Hernias sent to the Base for operation. In these cases a well marked sac, adherent and containing a small amount of fluid, was to me an argument unanswerable that a large per cent. if not all herniæ are congenital or at least show a "prehernial" condition. This prehernial condition is the deciding factor in the etiology; it only requires a certain amount of sudden or violent muscular effort to produce a complete hernia with or without strangulation, the sac being present before with perhaps closure of the funicular process at the internal ring.

Any change in the structural anatomy of the inguinal canal or the anterior abdominal wall which will permit of a successful outcome in these cases is, in my opinion, highly desirable. I believe experimental work should continue along this line both upon the cadaver and selected operative cases, in an attempt to so change the canal structurally as to permit of a decided lengthening of the spermatic cord. The secret of a successful operation for undescended testicle depends upon the construction of a new internal ring. Additional work should be done on Hasselbach's triangle in this connection and in opening up the inguinal canal behind the external ring, simulating a direct hernia, with complete transplantation of the cord through a newly constructed internal ring. Operative results in cases of this type are absolute proof that it is a much desired improvement over the older methods and it is to be preferred where the testicle is to be retained.

25 EAST WASHINGTON STREET.

ABDOMINAL HERNIA IN CONJUNCTION WITH APPENDICITIS AND IN WOMEN WITH DISEASE OF THE PELVIC ORGANS.

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A report of 200 cases of abdominal hernia operated upon by the writer is in preparation. Approximately 60% of patients with right inguinal, femoral or umbilical hernia also suffer with disease of the appendix demanding its removal. Of women operated upon for hernia, over 80% also suffered with disease of the pelvic organs.

In December, 1918, I reported in the *New York Medical Journal* the results of operation upon 600 cases of appendicitis. In 4% of these, or 24 cases, abdominal hernia was operated upon at the same time that the appendix was removed.

This year I am about to report the results of operation for pelvic disease in 600 women. In approximately 3% of these abdominal hernia was also operated upon at the same time. These percentages are much lower than the actual incidence of the associated lesions. In the earlier cases many herniæ were overlooked.

In the interest of the patient and as a means of increasing the standard of efficiency on the part of surgical operations in curing all the disease with which a patient is suffering, these observations are of real significance. People are coming in increasing numbers to be operated upon. The education

of soldiers concerning the need of cure of abdominal hernia, is leaking into the laity, putting truss fitters out of business and making it easy for doctors to urge people to be operated upon for this exceedingly common affection.

Reducible abdominal hernia, *per se*, unless complicated by inflammation or truss irritation, is not painful nor tender and causes few or no subjective symptoms. People who have hernia, however, when they have abdominal pain, not uncommonly attribute the pain to the hernia; and physicians and surgeons have shared this belief and advised that the hernia be operated upon for the cure of pain. Careful observation over a number of years and of a large number of cases has convinced me that when patients with reducible hernia complain of real pain in the abdomen, the pain will invariably be found to be dependent upon a lesion elsewhere, most commonly of the appendix and, in women, the pelvic organs. Infection and calculi of the urinary apparatus should also be borne in mind and the gall-bladder and stomach are commonly enough the seat of disease.

It is easy to understand why amateurs and occasional operators can be content to operate merely for hernia and fail to cure the affection of the appendix and pelvic organs at the same sitting. They are aware of their inability to do complete work and produce results of a high standard of efficiency and after gaining the patient's consent to permit them to operate, their next interest is to get the patient off the table alive. Moreover, it is not altogether incomprehensible why a certain type of commercial surgeon though skilful in his art, may reserve for a second operation and prolonged stay in the hospital, something to go back for; but we choose to believe that the real reason for the failure of a skilful surgeon to cure all the trouble at one sitting is due to his failure to recognize the frequency of the association.

The following brief case reports are illustrative as single examples of associated disease of the appendix and pelvic organs in about 80% of the right-sided and mid-line herniæ personally operated upon by the writer.

152340—Male, white, 25 years old, had known for two or three years that he had some swelling in the epigastric region. He has had repeated attacks of abdominal pain in several of which his doctor had seen him and informed him that his epigastric hernia was probably partially strangulated. A small fat-containing epigastric hernia just above the umbilicus and a long-standing badly diseased appendix, showing evidence of a recent attack, were revealed.

The appendix was removed and the hernia repaired. There was no evidence that any omentum or bowel had ever been in this hernia to have caused the abdominal pain. The appendix was the sole cause and a re-study of the clinical history was typical of recurrent appendicitis.

193118—Female, white, eight years old, was sent in for operation of umbilical hernia which she had had since birth. For the past two years she has suffered recurrent attacks of colic with vomiting. The hernia was at no time irreducible nor tender. At operation there was found a simple, uncomplicated umbilical hernia, of moderate size, containing no bowel or omentum, and showing no adhesions. The appendix was greatly thickened, strictured in three places and contained three enteroliths varying in size from a green pea to a grain of corn. The appendix was removed; the hernia repaired. A look at this case was quite convincing that the hernia was not the cause of the pain. The appendix was badly diseased.

193122—Male, white, 35 years old, was sent in for operation for right inguinal hernia which he had had for many years. He stated that his hernia had never caused him any pain, and he was to be operated upon for the hernia *per se*. Careful inquiry into the man's history elicited that when he was a boy he had a good many attacks of colic. He has not had any severe pain for several years but he has persistent "indigestion," at times severe, necessitating his being careful about the quantity and quality of his food. Each attack of indigestion was attributable by him to food indiscretion and while each attack was accompanied by moderate abdominal pain, his chief complaint was "dyspepsia." I told the man I believed he had chronic disease of the appendix. He felt so sure that he did not, that he requested me to respect his sentimental objections to removal of the appendix. I informed him that I would respect his wishes provided the appendix was not diseased, but I should insist upon examining it and if it was diseased, I should insist upon removing it. To this he agreed. Upon performing the operation according to the technic which I have been employing for several years (and which will soon be published in *Surgery, Gynecology and Obstetrics*), the appendix was found to be partially destroyed by previous disease and densely bound to the cecum and post-cecal structures by firm adhesions. It required 15 minutes of tedious dissection for its removal. The hernia was then repaired.

A review of this man's clinical history was typical of long-standing disease of the appendix and the lesion of and about the appendix was a serious menace to the man's life.

193089—Male, white, 25 years old, was referred for operation for femoral hernia upon which he had worn a truss for a good many years with great dissatisfaction, tenderness about the hernia and traumatism caused by the truss. He said he had had repeated attacks of abdominal pain, with nausea and vomiting, which had been attributed to the hernia. At operation, however, an incision made above the inguinal canal into the peritoneal

cavity above the neck of the hernia, (technic soon to be published) the appendix was found to be badly diseased and adherent requiring tedious dissection for its removal.

This man's pain and indigestion were solely attributable to the disease of the appendix. The hernia contained neither bowel nor omentum and there was no evidence that it had ever been strangulated.

193159—Female, white, 35 years old, had had femoral hernia since childhood for which she has worn a truss unsuccessfully and has had a good many attacks of partial strangulation and irreducibility. The last of these was two days before operation and caused her and her physician great alarm because of tenderness and irreducibility of the hernia, violent abdominal pain and vomiting. After a somewhat prolonged effort on the part of the patient, in the recumbent position, she succeeded in reducing most of the contents of the hernia and this was followed by cessation of the pain and vomiting.

Operation performed through an incision above the inguinal canal into the peritoneal cavity and above the neck of the hernia revealed a large mass of omentum firmly adherent and deep in the sac requiring tedious dissection for its removal and excision. The parietal peritoneum in the neighborhood of the hernia was also adherent to omentum and it was with considerable difficulty that the hernia was finally enucleated from its bed, inverted into the incision and excised, according to the method of procedure soon to be published. Palpation of the pelvic organs, through the incision, discovered a thin-walled right ovarian cyst about the size of an orange. While holding the cyst, preliminary to its removal, it ruptured. The cyst pedicle was sutured, the hernia enucleated and removed, the peritoneal incision and inguinal canal closed.

A review of the clinical history of this case revealed repeated attacks of pelvic pain and dysmenorrhea and it is not at all unlikely that some of the previous attacks of pain may have been due to this cause though the omentum was densely adherent to the hernia and there was clinical evidence that the hernia had been truly strangulated. An ovarian cyst of this size, however, is commonly conceded to be productive of symptoms and should have been removed independently of the existence of a hernia. It would not have been, however, if we had not looked for it.

The above five cases are picked at random from a large number of similar case records in my series of 200 operations for hernia.

CONCLUSIONS.

About 60% of all patients who come to operation for abdominal hernia also have appendicitis.

About 80% of women with hernia also have disease of the pelvic organs.

Appendicitis needs operation, pelvic organ disease calls for operation and all cases of hernia of less than colossal size should be operated upon unless, on account of extreme old age, severe cardiac or bronchial asthma or uncontrollable insanity, it is unwise or impossible to keep the patient recumbent a few days.

Patients with hernia who complain of pain in the absence of strangulation and inflammation are almost certain to have an affection in some other organ. Pain is not caused by uncomplicated hernia.

Every patient operated upon for umbilical, incisional or right-sided inguinal or femoral hernia should have the appendix removed at the same operation through the same incision.

Women with abdominal hernia should be thoroughly examined for disease of the pelvic organs. Associated lesions will be found in a large number of these cases. All that is pathological ought to be cured at the same operation through the same skin incision and when the pelvic disease is confined to the tube and ovary of one side, these may easily be removed through the incision employed by the writer in dealing with all types of inguinal and femoral hernia.

THE GERMICIDAL PROPERTIES OF SOME OF THE COMMONER VOLATILE LIQUIDS.*

Data obtained in the course of experiments with suture "tubing" fluids.

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Chloroform has been used for a number of years as a sterilizing and preserving medium—or, as it is designated among manufacturers, a "tubing" fluid—for catgut sutures put up in flame-sealed glass tubes and prepared and sold as sterile catgut.

We have examined into the qualifications of this and several other fluids in the course of an investigation as to their respective characteristics for this purpose. In the course of this research, we discovered several interesting and, we believe, valuable facts. These, as far as we are aware, are not to be found in the literature of medicine, chemistry, physics or bacteriology.

All of these related sciences are concerned in this work by reason of the fact that the conditions existing in a sealed glass tube are unique. This in the sense that, when such tubes are treated with steam after sealing, we have to consider the germ-

*From the Research Laboratories of Johnson and Johnson.

icidal action of fluids at temperatures above their boiling points. We have been unable to find in relative literature any reference to the germicidal power of any fluid—with the single exception of water—under these conditions.

The history of the use of chloroform as a catgut suture preservative or sterilizing medium probably dates back to Dr. Charles Rice, of New York City, whose name appears in the United States Pharmacopoeia of 1890 as Chairman of the Committee of Revision and Publication.

In his work at Bellevue Hospital Dr. Rice used chloroform containing mercuric iodide (the red iodide) in solution. This was a preserving fluid of high germicidal character. It was used to maintain a sterile and, at the same time, antiseptic condition in catgut, after a preliminary sterilization in other fluids. The solution was not heated[1].

The early use of chloroform by suture manufacturers as a tubing fluid for catgut was, apparently, a development of the Rice methods. The production of sterile catgut by processes involving the use of chloroform appears to have been largely empirical, for no knowledge seems to have been available as to any special reason for using chloroform. This, perhaps, because it was not known to have any specially high germicidal properties. Obviously, however, it did qualify for the purpose in the particular that it could be obtained, without difficulty, in a practically water-free condition. This was not true of alcohol, the fluid commonly used for catgut sterilization at that period. It is necessary that such fluid be anhydrous if it be the intention to sterilize catgut in it by heat above the boiling point of the fluid. Chloroform is also sufficiently volatile to evaporate quickly from the catgut strand upon its removal from the tube by the surgeon or nurse for use in the operation. At the same time, it is not so highly volatile as to cause sealed glass tubes of sound construction to explode when heated by steam much above its boiling point, which is about 60° C. Further than this, it was early demonstrated that chloroform, certainly in such quantity as that carried over by a catgut suture, does not irritate the wound, nor does it produce any toxic symptoms.

Chloroform is quite widely and successfully used as a preservative for aqueous fluids such as urine, glandular extracts, etc., and, since its solubility in water is only about one-half of one per cent., it is obvious that it must possess decided antiseptic properties and that, under these conditions, such properties are well-known and recognized.

The one and only clear reference to the germicidal properties of chloroform itself—that is, chloroform used alone—which we have been able to find is the statement in Sternberg's "Bacteriology" quoting Koch to the effect that "immersion for one hundred days in chloroform does not destroy the vitality of anthrax spores."[2] Special attention is here directed to the well-known fact that Koch's favorite method of testing the power of germicides at that period (about 1880) was by means of silk threads dipped in a culture of the organism. Reference to this will be made later on.

In our work in checking and controlling the various sterilization processes used in the laboratories with which we are associated, it is our practice to use a piece of material of convenient size for bacteriological manipulation and infected with organisms which represent maximum resistance. This we accomplish by means of a quarter-inch wide cotton tape that has been thoroughly extracted with hot water for the purpose of removing any possible sizing, and then immersed in a water suspension of spores of bacillus subtilis scraped from the surface of nutrient agar. This tape, in long lengths, is then hung in the laboratory for several days to dry and to collect any and all miscellaneous organisms that fall upon it. This latter procedure is followed in deference to the somewhat common belief that "wild" spores may be more resistant than the cultured variety. The validity of this belief seems to us to be open to dispute; but to avoid having our results questioned on that score, we regularly adopt this method.

The tape in question is cut into lengths of about one and one-quarter inch and kept for testing. To determine the lethal resistance of these tapes, we immerse them in water actively boiling over a free flame. We remove one of these tapes in one minute, a second in two minutes and a third in three minutes, etc,, immediately transferring them to culture tubes of broth. Our usual experience is to get a growth from the one-minute tapes and none from the two- and three-minute tapes.

To sterilize catgut by any heat method necessitates to all intents and purposes complete removal of moisture from the gut previous to the application of the heating process; otherwise, it is shrivelled and ruined. In order, therefore, to stimulate this condition with our test-tapes, we dry them in an oven at 100° C, for one hour. They are then transferred to glass ligature tubes of the usual size (about one-quarter inch by four inches), covered promptly with chloroform, or other fluid under investigation, and flame-sealed. Note that then we have a condition not commonly met with in bacter-

iological work, viz., water-free spores in a water-free liquid.

After these tubes have been submitted to the treatment indicated they are scratched with a file and that part of the tube flame-sterilized. The tube is then broken open, the tape being removed with flame-sterilized forceps in the usual bacteriological manner and placed in a culture tube of sterile broth. For this purpose, we follow our usual technic in testing ligatures, making ten cultures for every experiment and using large test tubes, each of which contains about seventy-five cubic centimeters of broth. We use this unusually large amount of broth for the purpose of securing a high dilution of the liquid carried over by the ligature or tape, thereby avoiding its possible inhibitory action upon the culture.

The following tabulations show the results which we secured in this work:

TABLE A.

Showing the killing power of several liquids at different temperatures, using spores of Bacillus subtilis from *water* suspension on *cotton* tapes.

Temperature and Time	Chloroform.	Ethyl Alcohol 99%	Ethyl Alcohol 95%	Methyl Alcohol 99%	Amyl Alcohol	Benzol	Toluol
25° C. (room temp.) for 24 hours.	10 tests 4 growths						
25° C. (room temp.) for 7 days.	10 tests No growths.						
25° C. (room temp.) for 21 days	10 tests No growths						
75° C. (in water) for ½ hour.	10 tests No growths						
100° C. (boiling water) for ½ hour.	10 tests No growths	10 tests 10 growths	10 tests No growths	10 tests No growths	10 tests No growths	10 tests 10 growths	10 tests 10 growths
120° C. (15 lbs. steam) for ½ hour.		10 tests 1 growth	10 tests No growth	10 tests No growths	10 tests No growths	10 tests 8 growths	

TABLE B.

Showing the killing power of *chloroform* at the boiling point of water, using spores of bacillus subtilis from *broth* cultures on *cotton* tapes.

100° C. (boiling water) for ½ hour.	10 tests 10 growths

TABLE C.

Showing the killing power of *chloroform* at several temperatures, using spores of bacillus subtilis from *water* suspension on *silk* tapes.

25° C. (room temp.) for 24 hours.	9 tests 9 growths
75° C (in water) for ½ hour.	10 tests 10 growths
100° C (boiling water) for ½ hour.	9 tests 9 growths

TABLE D.

Summary of those parts of tables A, B and C, showing results with *chloroform* at several temperatures, using test spores of bacillus subtilis from *water* suspension and from *broth* culture on both *cotton* and *silk* tapes.

	Water Suspension on Cotton	Water Suspension on Silk	Broth Culture on Cotton
25° C. (room temp.) for 24 hours.	10 tests 4 growths	9 tests 9 growths	
75° C. (in water) for ½ hour.	10 tests No growths	10 tests 10 growths	
100° C (boiling water) for ½ hour.	10 tests No growths	9 tests 9 growths	10 tests 10 growths

These tables exhibit three points of definite interest. It has been shown (1) that broth dried on cotton tapes protects the bacteria it contains from the action of chloroform; (2) that when that protection is absent (substituting bacteria from an agar surface and suspended in water), chloroform is found to be a germicide of power never before recognized; (3) that silk also has a protective or encapsulating character which renders it unfit for use as a medium for carrying bacteria for test purposes of this kind.

The tissue of which surgical catgut is made (sheep intestine) has this encapsulating property, as is generally known, and it always contains spores in that state. The many difficulties in the preparation of sterile surgical catgut sutures, are concentrated chiefly in the effort to overcome this condition without harm to the gut itself. Obviously, if chloroform or other "tubing" fluid will not penetrate the encapsulated spores, it is necessary to apply to the gut a thorough sterilization, preferably by direct dry heat, before the catgut is stored in the "tubing" fluid.

When this procedure is followed and the encapsulated spores are killed, the germicidal action of the chloroform, or other "tubing" fluid, is readily exercised upon the superficial bacteria, whether vegetative or spores, by which the gut may have become infected by handling, or from exposure after the preliminary heat-sterilization to which we have referred.

To us, the most striking feature presented is the complete protection afforded bacteria by the encapsulating action of the broth fluids when dried upon tapes. This protective coating, in all probability is the reason for Koch's report that chloroform is practically without effect upon anthrax spores. It is quite likely that he used broth cultures in his testing work, and it is almost certain that he used silk threads or tapes. It is plain that either of these factors would disqualify his results.

Referring to the killing power of chloroform on bacteria, it will be noted that it is far more effective than absolute alcohol.

The almost complete lack of germicidal properties of benzol and toluol under these conditions is, perhaps, worthy of note.

[1]Hospital Formulary Department of Public Charities, etc., of the City of New York.

[2]Manual of Bacteriology, Geo. M. Sternberg, M.D., 1893 edition, page 169.

THE IMPORTANCE OF THE PREPARATION OF THE AUTOGENOUS BONE GRAFT AND ITS APPLICATION TO ITS NEW ENVIRONMENTS.*

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One of the essential points in making a bone transplant is selecting the most potent location from which to remove the graft. While the transplantation of homogenous material—i. e., derived from a subject of the same species—may be useful in a limited number of cases, as a mechanical support, it is not all a matter of repairing the defect, but of supplying the proper means which will favor the reproduction of tissue to fill in, or correct, the defect. This is a well known fact, to those who do osteoplastic work. *We cannot repair a defect in bone,* but we can resort to procedures which will stimulate the regeneration of bone already present or remaining, thereby filling in the defect by the reproduction of tissue.

In order to be successful in this branch of surgery, a man must have a complete knowledge and a clear conception of embryology, histology, anatomy of bones and joints, as well as the form or type of regeneration, not only of the bone, but also of the soft tissues. No matter how this work is done, or upon what theory it is based, it must be carried out along definite lines, as closely as possible. It may be said with positiveness that the question of what sort of material, and from what source it should be taken, has been solved.

Not only has it been clearly demonstrated that the autogenous transplant is the only one to be used, but also that it should be taken from as near the location of transplantation as is possible.

Owing to the different histological formation of the various bones of the body: greater or less density, difference in circulation and nerve supply, and their greater or less distance from the center of circulation, which cause the environment not to be the same in all the bones of the body, it has been proven that if a transplant is taken from the same bone as that into which it is to be transplanted, the percentage of good results is greater than if the graft is taken from a distant part of the body. This would teach us, then, that environment has a marked influence on the results obtained in plastic bone surgery.

I have devised a plan by which the graft is taken from one of the fragments of the fractured bone: in place of lifting it out of its original bed, it is pushed into the marrow of the bone, and slipped up or down, whichever the case may be, dividing the transplant equally between the fragment-ends of the bone. The fractured ends of the bone are previously prepared, however, so as to permit passing the transplant into its future position, as above described.

Taken for granted that the tibia furnishes the ideal material for a transplant, on account of its firmness of structure, scanty blood supply, and superficial location, it would not be received as kindly if transplanted into the humerus, as if the transplant were removed from some portion of the shaft of the humerus, if that were practical. Therefore, the transplant should be removed, in all cases, from as near the location of its future bed, as is practical.

It is to be emphasized that a special technique should be employed in bone surgery. Rigid operative asepsis is to be maintained. Great care must be taken not to wound or lacerate the tissues any more than is absolutely necessary. The vitality of the transplant depends largely upon the care in removing it and retaining it in as nearly a normal condition as possible. The native blood and serum should be kept on the surface, as well as within the graft itself, consequently the change from the old to the new location, should be made quickly, so that nature's life fluid will be conserved and not dessicated or drained away. Should there be a temporary delay between the removal of the transplant, and the placing of it in its new bed, it must not be placed, or any attempt be made to preserve it in saline, or any other solution, because they remove that which should be retained: the fluids of its life (blood and serum), which sustain the vitality of the transplant.

In case of delay, the graft should be wrapped in a damp, sterile oil silk, to exclude the air, and retain the moisture; water or other liquid should never be applied to a wound in order to keep a motor saw, or any other cutter, from burning the bone or for cleansing purposes, for it invites infection, and removes the vital substance we wish to retain; in fact it always does more harm than good.

In controlling hemorrhage in plastic bone work, the tourniquet is contraindicated, because of the danger of reactionary hemorrhage following, with

*Read by title at the twenty-ninth annual session of the New York and New England Association of Railway Surgeons, in New York City, October 20, 1919.

clots in the deeper part of the wound, which would interfere with the vascularization of the transplant. To control the hemorrhage from small vessels and capillaries of the soft part and bone, the wound is packed with gauze, thoroughly wrung out of hot normal salt solution; arteries and veins of any size, are picked up with hemostats, and tied with absorbable ligatures. Great care must be exercised to see that all bleeding is controlled. Many operators have failed to obtain the desired results because of the lack of proper attention to the complete stopping of the hemorrhage in the bone, as well as in the soft parts. With hemostasis complete, the transplant may be placed in its new position.

The success of the transplantation also depends largely upon the actual contact between the osteogenetic surface of the host, and the osteogenetic surface of the transplant. Too much cannot be said in regard to the injury of the superficial cells of the bone-graft, or to the contacting surface of the host. Great caution should be exercised in preventing frictional overheating of the sawed surface, by the speed of the electric saw: also from contacting the graft to its host so tightly as to produce superficial necrosis. Also to be emphasized is the importance of bearing in mind that the antiseptics sometimes used, if brought in contact with the surface-cells of the bone graft, or its host, may do irreparable injury by destroying the cells of such surface; by the time the injured cells have degenerated, become absorbed, and cleared away, the underlayer of living bone of the host, and the graft, will have healed over, and will fail to unite or to graft over such surface.

The essential elements of a transplant are found in cortical bone, because of: its resistance to change of form, by which it gives support to its host; its small vascular supply which allows it to retain its vitality for a considerable length of time after transplantation; its capabilities of being sustained by a small amount of nutrition; and its active osteogenetic properties—all of which cause it to graft with rapidity and firmness.

The early vascularization of the transplant is materially aided when it is possible to leave the periosteum and endosteum intact. It has been forcibly demonstrated that small fragments of bone retain their vitality, and graft better and more readily, than larger pieces. The transplant, then, should be composed of the smallest amount of bone that will fulfil all the requirements.

The periosteum must be removed from intramedullary dowels, bone pegs, etc., where they have bony contact, or where they extend up into the ends of fractured bones. If the ends of the fractured bones come together, the entire graft should be denuded of periosteum or endosteum. If, however, considerable space exists between the ends of the fractured bone, that part of the transplant not covered by the recipient bone, should possess all the periosteum or endosteum possible. With this before us we can readily understand why the fibula makes such an excellent transplant in certain cases.

It is always advisable to use a quadrangular-shaped graft, especially so if it is an intramedullary dowel, for if the dowel fits perfectly in the bed made in the recipient bone, it prevents rotation of the fragments, or fractured ends of the bones upon each other, which is very essential. The proper fitting of the transplant to the host, furnishes fairly good fixation. With an inlay transplant it is necessary to reinforce the fixation by bone-pegs, or by the use of kangaroo tendon sutures passed through the holes drilled in the host and the graft, and tied over, or around, the transplant. Wire, nails, or any other metallic substances should *never* be employed as a means of fixation, because they act as a foreign body, and retard osteogenesis, and sooner or later they act as an irritant(and may cause suppuration as long as *twenty years* after their application. This fixation should be accomplished only with autogenous bone pegs or absorbable material.

Before applying the transplant, it is quite essential to place the limb in such position as to neutralize muscular contraction or to put the muscles at rest. To neglect this important detail, will allow a spasmodic movement between the transplant and the host. The position of the limb or member operated upon, should be one of normal alignment and rotation, in which there is complete relaxation of the muscles acting upon the area of osteoplasty. Should the above not be carried out in detail, the irregular movements or leverages, will either dislodge the transplant, shear it across, or cause it to cut through its bed or host, the course depending upon the direction furnishing the least resistance.

In all cases where bone transplants are used, it is desirous to place the limb or part in as near a quiescent state as can be attained. To accomplish this purpose, numerous splints have been invented, and a number of fixed dressings used, but there is nothing that equals a close-fitting plaster-of-Paris cast. The cast is applied to, and should include one or more joints, above and below the osteoplastic repair. The fixation must be complete and continuous, until stable grafting, or bony union has occurred between the transplant and the recipient bone.

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WALTER M. BRICKNER, M.D., F.A.C.S., Editor

NEW YORK, DECEMBER, 1919

SURGICAL LESSONS OF THE WAR.

If the Great War had been fought in the same manner and with the same weapons as the various, all too numerous wars that preceded it in this enlightened century, it seems probable that it would have developed no fundamental departures in medico-military practice, no great contributions to surgical science.

There were, however, two factors introduced into the recent warfare that profoundly altered the problems of caring for the wounded, the solution to which problems represent innovations and striking advances in the management of wounds—especially traumatic wounds—that are equally important in our civil practice.

The first of these factors was the general use of "high explosives," shell fragments from which caused very irregular lacerations of the soft parts (and shattering of the bone) and extensive "devitalization" of the tissues beyond the immediate tract of the projectile. The second factor was the richly fertilized, and therefore bacteria-laden, fields over which the war was fought—combined with the soiled condition of the soldiers' uniforms and undergarments. (The practice of bathing and change of clothing before a battle, introduced by the Japanese in their war with Russia, was quite impossible both in the trenches and in the later open operations of the last war.)

The combination of these two factors resulted in frightful wound infections—by streptococci and by gas-producing anaerobes—that were well-nigh universal and often fatal during the earlier years of the war: the prevention or management of which infections was the greatest surgical problem of the conflict. The ultimate solution of the problem is one of the most brilliant accomplishments in surgery, and ranks among the most important contributions to surgical progress in recent years.

The successful treatment of these war wounds was developed along two lines. The first of these was a reversion to antiseptic treatment, in the scientific evolution of which the wizard Carrel and his chemist associate, Dakin, were preëminent. It is quite unnecessary to rehearse the development of Dakin's hypochlorite solution and his later chlorine antiseptics, notably dichloramine-T; nor the nice and very scientific technic for their employment which Carrel and his associates evolved in their hospital at Compiegne. The very precision of those technics, and the organization of personnel it involved, discouraged and still seem to discourage many surgeons from employing the Carrel-Dakin system in their practice, despite the brilliant results early achieved by Carrel and by Depage. The beneficence of this method was amply demonstrated in our war hospitals where, for the most part, it was quite impossible to fully carry out Carrel's meticulous technic. Indeed, the timid surgeon may take assurance that he can secure results with the Carrel-Dakin treatment even without the desirable organization and ultra-precise methods of Carrel, provided he understands and carefully practices the fundamental principles involved in the preparation and in the dressing of the wound. More than that, it was found, for example, that Carrel's rule to delay secondary suture until wound smears show only one bacterium in five fields can be disregarded. A wound can be safely closed by secondary suture as soon as it is clinically clean, provided that smears show no streptococci or bacilli. This and certain other departures from Carrel's rules of wound closure were described in the interesting article by Bleier in the August, 1919, issue of the JOURNAL.

The Carrel-Dakin method is not a guaranteed preventive of wound infection nor a sure cure of suppuration; but we are inclined to believe that many, at least, of those who may still pooh-pooh it have not familiarized themselves with its management. It seems to us, too, that no surgeons who wants to employ it can excuse himself on the ground of lack of facilities, provided that he can secure the proper preparation and preservation of the Dakin's solution or the dichloramine-T.

The second, and more important, development in the treatment of battle casualties was the procedure that came to be known as "débridement," but which can be better described as "wound excision," since it consisted, in addition to the removal of all foreign bodies, of excising all the tissues (except

nerves and large vessels) immediately surrounding the tract of the projectile, usually also of small detached bone fragments and, too, of the free removal of all "devitalized" soft parts in the vicinity, however extensive that removal might need to be. Whenever possible the excision should be done "en bloc."

It was soon found that when this débridement, skilfully performed, was done within a few hours after the casualty was sustained, that is before "wound contamination" had become "wound infection," the defect could at once be closed by sutures, and that a large percentage of wounds thus excised and closed healed *per primam*. Indeed, primary wound suture after excision was thus performed in many cases in the British and, especially, in the French army—notably by Lemaitre, who is chiefly credited with the method. During an active "push," however, it was dangerous to perform primary suture in the forward hospitals, both because most of the patients had to be evacuated promptly on long train trips to the rear and because of the great fear of a lurking "gas gangrene" infection which might develop to fatal proportions in a wound thus closed before the soldier reached a base hospital. Indeed, primary suture was forbidden in the A. E. F., except of wounds of the head, the thoracic and abdominal cavities and the joints; and these latter cases were, as nearly as possible (and it was not always possible) retained in the Evacuation Hospitals for about ten days. No surgeon who worked in these forward hospitals will ever forget the odor of "gas gangrene" with which they often reeked, nor the fear of the possible development of this infection in his cases.

In civil practice these conditions do not obtain: the injured can be treated promptly and retained in hospital; the chance of gas gangrene infection is small and its possible development can also have immediate attention. Therefore, prompt excision and "primary suture" is quite applicable in a large percentage of the accidental wounds we are called upon to treat in civil practice. This, it seems to us, is the most important and most novel contribution of the war to traumatic surgery, the greatest boon conferred by experience in the conflict on the many who are injured in the industries, in traffic and by firearms. In the November, 1919, issue of the JOURNAL we called attention also to the employment of the Carrel-Dakin treatment as a means to the safe immediate suture of divided tendons.

The most striking results of débridement and primary suture were to be seen in "gunshot wounds" of the joints. Here the débridement of the tract of the missile, even through the bone, the removal of bone fragments and of foreign bodies, and the immediate complete closure of the capsule, were followed in a brilliantly large percentage of cases by primary union without infection. Many men today are enjoying the possession of a perfectly functionating and strong knee, elbow or shoulder joint that once harbored a piece of shell and a wad of dirty clothing, with a fracture of the articular end of bone. The French introduced the practice of washing out with ether joints and, indeed, all wounds, after débridement. Willems added the important step in the management of joint injuries of insisting upon early, indeed immediate, *active motion*, after operation.

In the treatment of joint suppuration also and more especially, Willems' system of active movement after free incision, is very helpful. Even more important, however, was the institution of *long* incisions into the joint on each side and the avoidance of all drains or packings. When joint suppuration was an extension from an infected gunshot wound of the extremity, as of the knee from compound fracture of the tibia or the femur, these long lateral incisions were the only hope of saving the extremity from amputation. It was our personal observation in these late, usually streptococcic invasions of the knee-joint — always most threatening—that after liberal lateral incisions some got well even where the associated fracture made active movements impossible, while others continued to do badly in spite of active motions. It must be said that in any such case thigh amputation was an imminent probability to save the soldier from advancing sepsis; and it was one of the tragic lessons of the war that such amputation must not be long delayed.

The employment of suspension and traction in the management of fractures of the extremity is not new in surgery; but its elaboration into a fully developed system, the evolution of its technics, the demonstration of its advantages in securing full extension and in maintaining the function of the muscles and the joints, are distinct products of the war. They constitute a highly important advance in this field of traumatic surgery, quite as important for civil as for battle casualties. In fractures of the femur and of the humerus, especially, whether simple or compound, traction and suspension, governed in their application by bedside roentgenography, are certainly superior to immobilization in splints or plaster of Paris.

In the development of this system many made important contributions — Steinmann, Codavilla, Chutro, Finochietto, Delbet, Hennequin, and others, and, of course, such earlier surgeons as Thomas and Hodgens. But it is not detracting from the accomplishments of other surgeons in the war to mention, in this connection, especially Sinclair of the British Army and Blake of the American Army. We commend to all surgeons not already quite familiar with the system the reading of Colonel Blake's excellent and graphically illustrated compend *"Gun-Shot Fractures of the Extremities."* It is an elaboration of an earlier (1917) article by Joseph Blake and Kenneth Bulkley, *Traitement des Fractures des Membres au Moyen de la Suspension et de la Traction,* is published in English by Masson et Cie., Paris, and was among the war medicine publications issued by the American Red Cross.

The importance of applying a Thomas splint, on the battlefield, in all cases of fracture of the thigh and leg—especially of the femur—was one of the lessons learned in the war. In civil practice it means that every ambulance should be equipped with a Thomas splint!

Many other problems and developments in war surgery — osteomyelitis, jaw fracture, secondary hemorrhage, sepsis, the management of injury to the posterior tibial artery, the association of compound fracture with injury to a large vessel, aneurism, gas gangrene, gunshot wounds of the abdomen, burns by explosives and by gas—have been repeatedly reviewed in the literature and cannot be discussed within the limits of an editorial. (The reader is referred to the excellent articles that have appeared in the JOURNAL, e. g. *Arterio-Venous Aneurism and Arterial Suture,* by Raymond Grégoire, October, 1919; *Maxillo-Facial Injuries,* by Shipley and Dillon, November, 1919; *Full Exploration of the Thorax in Recent Wounds of the War,* by Lilienthal, August, 1919; and to the editorials on *Shock,* August, 1919, and on *Wound Diphtheria and Diphtheroids,* July, 1919.)

We may, however, say a passing word about certain other broad fields of war surgery endeavor. In amputations perhaps the most important contribution was the personal experience acquired by so many surgeons. The "guillotine" or "sausage" amputation was commonly practiced as the safest and quickest, especially for gas gangrene. It was, perhaps, slightly the quickest but has little else to commend it and much to condemn it. It will not survive the war and has no place in civil surgery. The Italians achieved some interesting results in "kinetoplastic amputations," by which they provided various skin-covered loops and prolongations of muscles, with which to move prosthetic attachments. It is a promising field but still in the experimental stage.

In gunshot wounds of the brain remarkable results were achieved by débridement of the bone and, by irrigation and suction through a catheter, of the brain itself. When the brain could be covered completely by dural suture or, sometimes only by skin suture, or by fascia transplantation (as practiced by Neuhof) the immediate results were good. If the brain could not be, or did not remain, thus covered, if the soldier was too early evacuated to the rear, the result was regularly bad.

Just as in the Civil War the studies of Weir Mitchell and Keen wrote altogether new chapters in our knowledge of the clinical manifestations of peripheral nerve injury, so in this last war the brilliant and painstaking observations of Mme. Athanassio-Benisty, of Tinel, Henry Meige, Pierre Marie, Sicard and others, have added innumerable data to the symptomatology of peripheral nerve injuries and have greatly modified our conceptions of the physiology of some of the nerves, of the pathology and the phenomena of interruption of their fibers, of the processes of repair and of the indications for treatment. Among others, the works of Tinel and of Mme. Benisty (except, perhaps, her latest, *Les Lesions des Nerfs, Traitement et Restauration*) are available in English translation. The results of surgical operations on gunshot injuries of the nerves have not yet been collated and digested. Briefly we may state, however, that there are two outstanding lessons: first, the importance of conservatism and, second, that wherever possible end-to-end suture, conducted with the utmost gentleness of manipulation, offers much better prospect of restoration than any graft or nerve-plastic operation.

In the surgery of the chest much indeed was learned: the management of hemothorax and of so-called "sucking wounds," the indications for and against operation, approach to and exposure of the lung, the removal of foreign bodies from and débridement of the lung, the extraction of missles from mediastinum, pericardium and diaphragm. Petit de la Villeon, working at the French naval hospital in Brest, with the assistance of the roentgenographer, Le Coniac, developed a unique method of extracting missiles from the lung, under the fluoroscope, by means of forceps thrust through a small incision in the chest wall. His article in this issue of the JOURNAL, presenting his results, the indications and contraindications and, in outline, the technic, explains the method and its rationale. It is, however, a method safe only in the hands of one who has repeated opportunity to develop the necessary experience and dexterity, and is scarcely applicable in the occasional case that the surgeon will encounter in civil practice.

A fruitful opportunity was presented by the war for the study of empyema thoracis, both as it occurred from gun-shot wounds and, especially, as it was seen in so many cases in the camps during the epidemics of measles and of "flu." The important lessons learned therefrom were: that it is dangerous to operate before the effusion has become frankly purulent, *i. e.,* before the lung has become adherent to the parietal pleura about the pus collection; that if Carrel-Dakin treatment of the cavity be instituted after the incision and conducted *lege artis* complete healing without secondary operations will usually follow; that frequent recourse to the Roentgen ray is important to the successful conduct of the case, as it is also, of course, in gun-shot injuries to the chest.

In the search for a remedy for gas gangrene Bull's serum, which appeared to be a specific antitoxin for the Welch bacillus, proved a failure in the war zone, for it gave no protection against the other gas-producing organisms commonly present. Other efforts, based on the recognition of the rôle of these other anaerobes were also failures. Just before the termination of hostilities, however, Weinberger, long at work on this problem in the Institute Pasteur, evolved a triple antitoxin which appeared to be curative. Chutro, in Paris, used it in several apparently desperate cases with striking results. Unfortunately, it appeared too late to be tried out on a large scale.

In plastic restorations, as of the face, no new principles were evolved, so far as we know, but quite remarkable skill was developed by several surgeons among those to whom this work was allotted.

Indeed, it should be said, finally, that among the very important contributions of the war to civil practice is the vastly increased experience in traumatic surgery of many surgeons in all the participating countries.—W. M. B.

Surgical Sociology

Ira S. Wile, M.D., Department Editor.

SURGERY IN STATE HOSPITALS.

In the development of state hospitals an effort is made to secure rational and humane care for the insane. For the most part it is true that owing to the prevalence of dementia precox these institutions are largely places of shelter for those bereft of reason until they are relieved by death. The percentage of cures resulting from treatment in state hospitals is exceedingly small, and the main gain therefor may be said to be the protection of the community against the hazards of the insane at large. According to H. M. Pollock, statistician of the New York State Hospital Commission, and E. M. Furbush, statistician of the National Committee on Mental Hygiene, the daily average population of the state hospitals for the insane, based upon the returns of January 1, 1918, was two million, nine hundred and sixteen. The total cost of maintenance for the year 1917 was approximately forty-four million dollars, the per capita cost being $247.-28. These figures, of course, are not indicative of the number of insane in the United States, nor do they suggest the reason for the increasing admission rate in such institutions.

With the term "hospital" there is usually bound up the idea of surgery, though it is probable that the surgical phases of state care have not received adequate attention. In *The Institution Quarterly,* Volume X, No. 3, S. W. McKelvey and C. C. Ellis in separate articles refer briefly to the necessity for organizing surgical clinics in all state hospitals. The purpose of such surgical services is not merely for the relief of physical conditions producing pain and discomfort, but for the removal of any annoying conditions which may be interfering with the development of a proper mental attitude on the part of the patient. As Dr. Ellis comments, we have no right to assert that a patient is hopelessly insane and therefor that it is useless bother to give surgical relief, unless of course the life of the patient demands it. It would be contrary to the spirit of surgery to refuse surgical aid for acute abdominal conditions, on the theory that an early death would be a blessing to the patient and his family, and a relief to the state.

Among all insane patients there exists an abundance of clinical material to which little attention is given but which demands the highest degree of care, particularly in view of the fact that the state assumes the responsibility for the physical and mental betterment of those comprising the population of the state hospitals. The mere fact of being an inmate of a state institution should not serve to lower the character of medical care given, but should on the other hand, guarantee a greater degree of interest and scientific service.

In any large institutional population there is bound to be a large variety of surgical conditions demanding diagnosis and treatment. There are possibly some difficulties in diagnosis owing to the necessity for depending upon objective symptoms and laboratory findings. There is no difference between the surgical technic employed in the operations upon the sane and the insane.

The character of the surgery must vary greatly and includes operative procedures upon the eye, ear, nose and throat, the treatment of accidents, and the relief of chronic conditions, such as hernia, hemorrhoids, prolapsus uteri, fibroids, infections of the gall-bladder and appendix, old depressed fractures of the skull, varicosities in various parts of the body and similar pathological states undermining vitality and reflexly influencing unhappily the mental state. Under these circumstances it is patent that the development of surgical work in state hospitals for the insane should be given encouragement and support.

Not merely in the interest of state institutions but because of the benefit to the general public, every advantage should be taken of the opportunities for studying the inter-relation between the mental and physical conditions of individuals before and after they have received the benefits of operative treatment. From the standpoint of widening the spnere of surgical usefulness there should be an extension of the surgical service of state institutions to the end that every inmate should have his physical state restored to its fullest potential of effectiveness and power. Insofar as may be possible there should be no untreated conditions for which surgical skill might afford a remedy.

To make the most of state hospitals, their value for teaching must be appreciated, and this should include demonstrations of the surgical benefits that can be conferred as well as an analysis of the physical factors entering into the causation and prolongation of mental disease. In the training and equipment of nurses, orderlies, and internes, it is equally important that the surgical requirements should be modern and up to date and that the surgical clinic should take its proper place in the scheme of hospital organization.

The vast population in state hospitals is not to

be regarded as a group segregated merely in the interest of society but as a mass of unfortunate beings placed in an institution wherein is to be found all that medical and surgical skill can offer towards re-establishing them as rational, self-sustaining, law-abiding individuals.

Progress in Surgery

A Résumé of Recent Literature.

A Report of the Work Carried Out at the Radium Institute, London, from January 1, 1918, to December 31, 1918; Conclusion. A. E. HAYWARD PINCH. *Radium*, September, 1919.

This is a complete report summarizing all cases treated. The following extracts should be of interest.

Warts, Papillamata and Granulomata.—Radium is of the greatest possible use in effecting the removal of warts from situations where the excision or the employment of powerful caustics is to be deprecated, e.g., the eyelids, lips, urethra, penis, and labia.

Leukoplakia, whether of the mouth or vulva, is almost always much benefited by radium, and the pruritus which is so general a symptom in the latter situation is greatly relieved. The condition, however, exhibits a strong tendency to recurrence, more especially when the patient has suffered from specific disease.

The screening employed, and the length of exposures, have to be varied in accordance with the character of the lesion—thin and glazed, thick and opaque, ulcerated and fissured. In the early stages screening of 1-10 mm. of lead is employed, and exposures of one to two hours' duration given; in the later stages the screening is altered to 1 mm. of silver, and the exposures are of from six to eighteen hours over two or three successive days.

Many kinds of *skin diseases* are favorably influenced by radium irradiation.

The character of the treatment to be adopted varies within very wide limits, but, speaking in general terms, it may be said that when the disease is confined to the epidermis, e.g., eczema, psoriasis, lichenification, etc., the best results are usually obtained by short unscreened exposures of from three to five minutes' duration on each of three successive days, or one such exposure of ten to fifteen minutes' duration, the former method being preferable.

When infiltration of the corium or deeper tissues is present, e.g., xanthoma, mycosis fungoides, the later stages of xeroderma pigmentosum, fibroma, etc., longer unscreened or prolonged screened exposures are indicated.

Keloids and Vicious Cicatrices.—Radium rapidly produces great and permanent improvement in these conditions, especially when they have not existed for any length of time, and occur in young subjects.

The routine treatment consists in exposures of eighteen to twenty-four hours' duration with half-strength applicators, screened with 1 mm. of silver, the series being repeated at intervals of about six weeks.

A gradual, but steady, absorption of the keloidal or fibrous tissues occurs, and there is but little, if any, surface reaction. The tenderness and itching of the keloidal tissues if present usually disappears within a fortnight of the first treatment.

The radium treatment of *cavernous nevi* may be regarded as most satisfactory, and though the procedure is a somewhat lengthy one, screened exposures having to be given at six weekly intervals for six, nine, twelve, or more months, the result is always superior to that which could be obtained by any other measures. *Capillary nevi* are not so favorably influenced, and though the removal of a small capillary nevus may quickly be brought about by the employment of a destructive reaction of moderate degree, this method is not practicable in the case of large and widely distributed port wine stains by reason of the extensive scarring which would result. It is, however, often possible to reduce the tint of these lesions to a pale salmon-pink color, which is easily concealed by a slight covering of face powder.

Much care and experience are needed for the successful treatment of these cases. The factor of personal idiosyncracy is always a very pronounced one, and there is a great tendency to the appearance of telangiectases in the treated areas, which require to be destroyed with the electric cautery so soon as they develop.

Tuberculous Adenitis.—In the earlier stages, before caseation has occurred and fluctuation is appreciable, radium treatment is often of great value, as it will occasion shrinking, and fibrosis of the affected glands, thus postponing or averting the employment of surgical measures. Half-strength applicators screened with 1 mm. of silver are employed, the total exposure being of eighteen to twenty-four hours' duration, distributed over three or four days.

Tuberculosis of Skin (Lupus Vulgaris).—Cases of long standing which have proved non-amenable to Finsen light, *x*-rays, CO_2 snow, scarification, caustics, etc., are sometimes quickly and effectively cured by radium, and the treatment is well worthy of a trial when other methods have failed. Definitely ulcerated areas should receive unscreened exposures of one to one and a half hour's duration, and a destructive reaction produced. A smooth, supple scar results.

The indurated and non-ulcerated areas are best treated with prolonged exposures, the apparatus being screened with 1 mm. of silver or 2 mm. of lead, the screening and exposures being varied in relation to the extent of the induration.

Goiter.—Radium therapy is not to be advocated as a routine method of treatment for this condition, but in those cases where the usual medical treatment has failed to produce any benefit, and the patient has declined operation, it is worthy of a trial. The best results are to be anticipated in the simple parenchymatous type; cystic growths, and multiple dense fibro-adenomata are but little, if at all, benefited.

Exophthalmic Goiter.—The milder forms of this disease, unassociated with diarrhea, vomiting, rapid wasting, and extreme nervous exhaustion, do well under radium treatment, either alone, or as an adjunct to the usual medical measures.

Prolonged screened exposures should be given, but it is advisable to proceed cautiously at first, and not use too large an amount of radium, keeping the patient under careful observation for the first few months.

Not infrequently the immediate effects of the treatment are to increase the influx of thyroid secretion into the blood stream, thus producing a marked exacerbation of all the symptoms. In such cases it is advisable to decrease the amount of radium employed and the length of the exposures, and give smaller doses at more frequent intervals.

Fibroid Disease of the Uterus.—The menorrhagia and metrorrhagia, which are the usual concomitants of this condition, are almost invariably checked, sometimes completely abolished, by radium treatment. Some diminution in the size of the existing tumor may also be produced, but this result is not always obtained.

Prolonged exposures of thirty hours' duration are given, a 100-mgr. tube, screened with 2 mm. of lead and 3 mm. of rubber, being placed within the uterus—or in the posterior fornix if this be impracticable—supplemented with a plate of equal strength screened in similar fashion, and applied over the fundus.

In many instances one such series of exposures proves effective, in others two, three, or four series may need to be given at intervals of not less than four months.

The most suitable cases for treatment are those in which the patient is over forty years of age—so that the establishment of a premature menopause is not a matter of any very great moment—and the tumor is of moderate size, and not the site of any inflammatory or degenerative changes.

Chronic Metritis—Uterine Fibrosis.—This exceedingly obstinate condition, which so frequently defies all gynec-

ological measures short of removal, often yields in a remarkable fashion to radium therapy. The metrorrhagia is cured, the menorrhagia lessened, and menstruation becomes normal in character.

Prolonged screened exposures of about thirty hours' duration are necessary, both intra-uterine and extra-uterine applications being employed.

In cases of long standing the exposures may have to be repeated three, four, or more times, a procedure which usually induces the premature establishment of the menopause.

Arthritis Deformans.—The daily administration of 250 cc. of radium emanation solution of a strength not less than 1.5 millicuries per litre, continues to give excellent results in selected cases of this disease. The patients who are most favorably influenced are those in whom fibrous, as distinct from osseous, changes are predominant, and in which the condition is infective, rather than traumatic in origin.

Cases of long standing with bony ankylosis, osteophytic formation, or ulceration of interaricular cartilages derive but little benefit beyond possible relief of pain.

Intentional Removal of Skin and Other Tissues Overlying Deep-Seated Inoperable Cancer, a Necessity for Effective Treatment with X-Ray or Radium. With Report of Relative Absorption of Rays by Skin, Fat and Muscle, as Compared with Various Thicknesses of Aluminum. EMIL G. BECK and G. W. WARNER, Chicago. *Surgery, Gynecology and Obstetrics,* October, 1919.

Confronted with a recurrent carcinoma of the breast or neck, for instance, the surgeon is apt to be too pessimistic in regard to the possibility of helping the patient. Usually the patient is referred to a roentgenologist for radium or *x*-ray treatment. We hesitate to do anything further surgically because we feel that if the surgeon was not able to eradicate all of the cancerous growth at the first operation, a second operation is apt to be much more difficult and not likely to be as radical as the first one. While recurrent cancer is not a promising field for the surgeon, still we have not yet exhausted all of our efforts. Even in apparently hopeless cases something more can be done.

The authors report four cases in which this procedure was carried out, with good local results from radiation of the large exposed wound. They also point out that:

The skin absorbs about as much as does three-fifths of a millimeter in thickness of aluminum, which is considered by roentgenologists a substantial filter for the rays; one-half inch of fat would arrest on the average about as much of the rays as two-fifths of a millimeter of aluminum would filter; three-quarters of an inch of muscle is capable of absorbing all the *B*-rays from radium.

It is a well known fact that superficial malignant growths, such as epithelioma, respond readily to *x*-ray and radium treatment, while deep-seated malignant growths do not. The reason for this is very suggestive: the skin, fat, and subcutaneous tissues which usually overlie deep-seated cancer are strong filters for the penetration of the *x*-rays, they absorb most of the soft rays from the *x*-ray tube and allow only the hard rays, which is a small quantity, to penetrate deeply enough to reach the growth. Small quantities of radiation, instead of destroying the cancer-cell are apt to stimulate it to more rapid growth. Therefore it has seemed that if the skin and all the overlying tissue and as much of the growth as is feasible is removed and a large area left entirely exposed, and to this field is then applied either the *x*-ray or radium directly, we may obtain similar results in treating deep-seated carinoma as are usually obtained in treating superficial growths. In other words, our problem is to convert the deep-seated growth into a superficial one.

In an appended report, in which absorption was determined by an ionization method, Warner states: "It is usually unwise to attempt to draw a conclusion from incomplete data but it seems safe in this case to predict that a few centimeters of body tissues would act effectively as a screen for nearly all the soft rays, but would be quite transparent to hard rays. Hence if it be the soft rays that are valuable in therapeutics, the removal of parts overlying the diseased organ is quite essential; but if hard rays are the valuable ones, then removal of the overlying tissues seems unnecessary."

The Treatment of Uterine Cancer by Radium. HENRY H. JANEWAY, New York. *Surgery, Gynecology and Obstetrics,* September, 1919.

Janeway presents a very careful analysis of the statistics of operation upon cancer of the ceroix and body of the uterus. The actual figures deduced from a thorough study of obtainable data, he summarizes as follows: operability of carcinoma of the uterus 37 per cent; mortality of operations, 17 per cent; curability of cases operated upon (based on 5-year standard), 21 per cent; for all cases, 9 per cent. However, the general mortality must be considerably higher, as not all cases are operated upon by highly skilful surgeons. The impressions gained by many observers are that the primary mortality and subsequent dangers in the way of post-operative complications are so great, that the small percentage of cures does not justify the raidcal operation. In addition, it must be remembered that only few surgeons can perform the operation well.

Janeway then presents the recent statistics of radium treatment of carcinoma of the cervix, quoting authorities such as Wickheim, Doederlein, Kelly and Burnam, Barsh and numerous others; appending reports of 17 cases treated by himself.

His conclusions from the cases treated are expressed in his own words as follows: "A review of the cases reported in this paper, does not, of course, prove that radium is at the present time the method of choice for treating carcinoma of the fundus or cervix uteri. Taken, however, in conjunction with reports of other observers quoted in the literature, it suggests that in only a few years there will be ample proof, that radium is the method of choice in the treament of cancer of the uterus, at least of that most frequent form of cancer of the uterus, and the most difficult to manage, the cervix."

"Contrasting the immature record of radium, with the statistics of the operation, the fact that it has produced cures of two or four years' standing in cases too extensive for operation, that it has produced cures of three years' standing and over in a larger percentage of early cases than the operation has produced, one author claiming for it in this stage 100 per cent of cures; the fact that treatment by it in no way interferes with the patient's routine life, and subjects her to no risks; the fact that it is a remedy capable of being used by anyone possessing the simplest gynecological training, after receiving certain easily acquired technical instruction; contrasting these facts with the operative records, is not the time ripe to urge each county medical society to make the effort to place a supply of radium in its district?"

Further Observations on the Radium Treatment of Uterine Cancer. HAROLD BAILEY, New York. *The American Journal of Obstetrics,* September, 1919.

Bailey discusses at length the pre-operative and post-operative treatment of cancer of the uterus as well as the treatment exclusively by radium. He lays particular stress on the proper selection of cases and the necessity for having large doses of radium at hand. His conclusions are here presented:

Practically all of the cases that have a complete radiation of the local lesion, and the lymphatic and other involved tissue in the parametrium, pass through a period of improvement. In all but the more advanced conditions this improvement consists of a disappearance of the ulceration, a lessening or entire disappearance of the discharge, a gain in weight, and general improvement of their health. Undoubtedly their lives are lengthened. A number have some slight degree of rectal irritation, beginning a week or ten days after the treatment, and lasting two or three weeks. A few have a fibrosis of the pelvic connection tissue, especially at the bases of the

broad and uterosacral ligaments. After a longer or shorter time of well being following the treatment, many of the cases have further development of cancerous tissue behind the vault of the vagina. In the effort to save these patients that have a retrogression after six or eight months, Bailey pushed the radium treatment of the parametrium, both by vaginal and by surface radiation to the highest limits of safety, and have thereby caused in many who now appear to be free from cancer, various types of pelvic sclerosis, both mild and severe. It was wise to recede somewhat from the massive dose given by the bomb applicator. This dose now is actually in the neighborhood of three-fourths of the maximum; the dosage in 1917 being about one-half the maximum.

The method in use permits of the entire treatment being given in a forty-eight hour period, and with only moderate discomfort to the patient. The local slough and signs of irritation in the vault of the vagina, seen so frequently in using the older method is now lacking in most of the cases.

The most spectacular results in the entire series were those of four Wertheim operations, which followed a month after the radiation. In three of these, no cancer cells were found in the uteri or parametrial tissue that was removed; and in the fourth case only a few markedly hydropic and degenerated cancer cells were present in the parametrium. It must be admitted that in these cases, at least, the radium caused the tumor cells to disappear even more thoroughly than ablation could have removed them. If such results could be looked forward to with any degree of regularity, then the very reason for the operation would cease to exist. It should be a very simple problem to settle, for all time, the relative merits of these procedures. Twenty-five consecutive cases, well controlled, would show how dependable are the results of this type of radiation. Without the removal of the uteri of some such number with a plan carefully followed, there will always be uncertainty, for even in the cases of this series, where there was every reason to believe that the patient would be restored to health, after a year one is dead, and two have massive involvement in their pelves that is apparently cancerous. The question at issue is not the cure, but whether radiation will cause the permanent disappearance of cancer cells, from a region as wide in its limits as the area that would be removed by the most complete hysterectomy of the Wertheim type.

From results in the uterine body cancers, it would appear to be necessary to remove the uterus after a preliminary radiation, or where this is inadvisable to radiate the entire pelvis as completely as is done with a cervical tumor.

The results in recurrent cancer are very promising.

Epithelioma of Solar Origin. W. DUBREUILH, Bordeaux, France. *The Urologic and Cutaneous Review*, November, 1919.

Dubreuilh has analyzed over 400 cases of epithelioma and rodent ulcer, and senile keratoma, from which he infers that the exciting cause is undoubtedly chronic insolation. The details of these cases are presented, with the occupations of the patient and exact anatomic position of the lesion. While age is a predisposing factor, chronic insolation was demonstrable in nearly all the cases.

The following conclusions are drawn from the study.

Senile epithelioma of the face is not caused solely by age.

It is the result of chronic insolation, and the study of it should include chronic radio-dermatitis.

It occurs with particular frequency among farmers and others who live in the open, exposed to the full sun.

Blond persons having a skin of little pigment are much more subject to effects of the sun, while this is rare with brunettes and still more so with those of the colored race.

It is essentially a rural malady.

Is Carbuncle a Medical or a Surgical Disease? DOUGLAS H. STEWART, New York. *Indianapolic Medical Journal*, October, 1919.

Stewart calls attention to the decreasing frequency of carbuncle. He decries the principle that every carbuncle should be freely excised or curetted. He believes that a carbuncle is a "boil on a gangrenous base." Excision of the gangrenous area is contra-indicated unless a distinct line of demarkation has formed. The only indication for early operation is in those cases with extreme induration, pain, and severe constitutional symptoms.

The routine treatment employed by Stewart is to have the patient lie face down (usually) upon an operating table and to apply a compress soaked with a saturated solution of phenol that is left in contact for ten full minutes, while other patients are being attended to. This is for anesthetic purposes only and is removed when, if there are openings in the growth, they are injected with Stewart's biniodide solution, which contains one grain of calomel to two ounces each of alcohol, tincture of iodine and glycerine. The whole growth and its neighborhood is given a generous and extensive painting with the aforesaid solution, but the whole is finally covered with a compress soaked in "purple" (iodin gr. i. paraffin ʒ i). A carbuncle appears to be the sole surgical injury that is benefited by much handling with frequent change of dressing. That "purple" prevents the adhesion of the bandage may be a factor in this matter. At any rate the biniodide is applied three times a week and the purple soaked bandage is changed three times a day if time serves. The cases referred to are broken down from exposure, alcohol, lack of food, etc., therefor no pieces are removed save as they come free and are picked up with forceps. The frequent changes of dressing seem to militate against the chances of multiple infection. The only medicine that seemed to be of the slightest use was the well known Syr. hypophosyh, cum ferro, but this was excellent, therefore many other remedies were tried only to be soon discarded. Vaccines have been used rather extensively and have a very definite value if the dosage be large enough. The question is whether carbuncle does better under medical or surgical treatment; the answer is under medical measures, save only in those neglected cases in which the most urgent demand is to relieve tension.

The Importance of the Spleen in Resistance to Infection. DUDLEY H. MORRIS and FRANK BULLOCK, New York. *Annals of Surgery*, November, 1919.

The authors conducted an investigation to determine the rôle played by the spleen in combating infection. For this purpose they used rats, because they are more susceptible to the ordinary pathogenic microbes. Thirty-six young brindle rats, weighing from 50-100 grammes each were splenectomized under anesthesia. A similar number had one testicle removed. Both series were active and healthy on the day following operation. They were then exposed to chance infection, from laboratory contagion, and kept under observation for several months. The death rate in the splenectomized animals was 80.5% as compared with 38.9% in the controls. The autopsy findings were those usually found in rat plague. They deduce from these findings that the splenectomized rats were more prone to contract rat plague, and that having contracted it, they showed less resistance to its ravages. In another series of experiments, the authors showed that splenectomized rabbits were far more susceptible to common infections than control rats. In a third series, following injection of the bacillus of rat plague, the same lack of resistance in the splenectomized rats was noted.

The authors' conclusions are as follows: While rats may get along fairly well without the spleen in the absence of any infection, the reverse is the case when the organism is put to the strain of resisting acute bacterial invasion. The inference is that the spleen normally aids tremendously in resisting infective processes in rats, and that its removal temporarily robs the body of its resistance.

The surgical bearing of these results is obvious. If as we reasonably infer, the physiological processes of mammals are similar, it is not improbable that the human body, deprived of its spleen, shows a similar increased susceptibility to infection.

The Treatment of Unopened Mammary Abscesses. JOHN P. GARDINER, Toledo. *American Journal of Obstetrics,* November, 1919.

In an exceedingly interesting article, which carefully covers the literature of mammary abscesses, Gardiner reports a new method of treatment of mammary abscesses, without incision, which possesses manifold advantages over the generally accepted method of incision and drainage.

1. Care of the lactating breasts and nipples means: (*a*) Cleanliness; (*b*) Avoidance of prolonged and frequent nursings during the first days before the milk comes in; (*c*) Early recognition of a failing milk supply and the immediate institution of supplemental feedings; (*d*) On the first sign of any trouble, nursing is to cease temporarily and the lymphangitis is combated by pressure and cold to the breast.

2. Drainage is accomplished by frequently repeated aspirations. Upon this one point plus constant pressure depends the success of this method of treating breast abscesses.

3. The second aspiration is performed four to six hours after the first aspiration. The amount of fluid, obtained at this aspiration, will determine the frequency of the following aspirations.

4. Each succeeding needle puncture is made through the original puncture and is always preceded by local anesthesia.

5. The time of healing in the cases reported was from four to nine days.

6. Abscesses contiguous to the original abscess are not difficult to locate, because the pressure exerted by the bandage prevents any excessive edema, so that any induration between the skin of the breast and the chest wall, is readily recognized by palpation. It is usually easy to drain, by aspiration, these contiguous abscesses through the original abscess cavity.

7. During the acute stages before the abscess has localized, it is essential that the pressure bandage should not be removed from the breast, except for the briefest time possible and the pressure bandage should be continued several days after there has been a dry tap.

8. Cold should be continuously applied unless pus is present, when heat is substituted.

9. From a psychological viewpoint, the aspiration method should be the method of choice, as there is practically no scarring to recall the patient's suffering.

10. Prenatal care of the nipples does not prevent the occurrence of sore nipples or breast abscesses.

11. Every nursing woman should be impressed with the fact that by caring for the breasts and nipples, at the very first sign of trouble, she may escape many days of acute suffering and also years later she may perhaps avoid the development of a mammary carcinoma.

Delivery by Hysterectomy Without Preliminary Opening of the Uterus. The Fetus Remaining Alive. [L, Accouchement par Hystérectomie sans Ouverture Preálable de l'Utérus, l, Enfant etant Vivant.] RENE LECOCQ. *Annales de Gynécologie et d' Obstétrique,* October, 1919.

In cases where secondary hysterectomy would be indicated following a Cesarean operation, or after labor, Lecocq advises removal "en bloc" of the uterus with its fectal content, as if it were a huge fibroma; after the uterus is removed and the operation is being finished, the uterus is opened by an assistant, preferably in another room, and the child removed. This operation was first performed by Emile Raymond in October, 1911. It has been performed five times since. In each case the child was saved. In one case the mother died.

The indications for the operation are the same as for hysterectomy.

1. Probable infection of the uterus, because of necessary mechanical interference.

2. Large fibraid or cancer of the uterus.

3. Necessity for a rapid delivery in face of threatened rupture of the uterus.

4. Complete uterine inertia, occurring at the time when Cesarean operation is indicated.

5. Placente Previa with severe hemorrhages or bloody infiltration of the uterine musculature.

6. Prevention of accidents of osteomalacia.

The following points in technic are mentioned. A large sterilized basin should be ready for the reception of the uterus with its contents. All preparations should be ready for resuscitation of the child. Preparation of the patient as for a simple hysterectomy. A large abdominal incision, 23 to 25 cm. is made, the abdominal wall which is then carefully raised and the uterus delivered. The broad ligaments and round ligaments are clamped and divided. The peritoneum is incised near the cervix and pushed forward. The uterine arteries are exposed and clamped, and the uterus rapidly removed, with or without the cervix. The second uterine artery may be caught, after the uterus is removed, so as to maintain placental circulation as long as possible. The rest of the operation is like a simple hysterectomy. In the meantime the uterus is opened and the fetus removed and resuscitated if necessary.

The post-operative course is simple, and the complications are those of a simple laparotomy. There was only one maternal fatality in the five cases. The child lived in every case.

Are the Operative Procedures Done for Dysmenorrhea and Sterility Justifiable in the Light of Developmental Study. FREDERICK C. HALDEN, New York. *American Journal of Obstetrics,* October, 1919.

In the study of sterility and dysmenorrhea one should differentiate between those cases which are due to inflammatory disease and those which are the result of developmental defects. Unfortunately this distinction is not made by the average gynecologist.

The author is in accord with the statement of Garretson that the life of every woman is dominated by her ductless gland system. Certain of these glands assume a dominating influence on the morphology, physiology and pathology of the individual and by reason of this, we are able to designate persons in terms of glandular types recognizing thyroidal, adrenal, pituitary and gonadal types, many of which are mixed types and designated thyroadrenal and pituitous renal.

But few cases of dysmenorrhea need any form of operation. It is fallacious to suppose that the pin-hole os, the long cervix, the anteflexed uterus have any actual etiological relation to painful menstruation, when one realizes that menstruation is not controlled in the uterus but by the ovaries. These abnormalities while they do not cause dysmenorrhea *per se*, cause a circulatory stasis which increases after marriage. This circulatory stasis produces a permanent pathology not only in the uterus but in the ovary. The uterus drops in the pelvis, is edematous and as a result there is a deposition of round cells which increases its bulk. The ovaries have their circulation interfered with and the same engorgement takes place within the stroma and the same deposition of round cells takes place within the capsula. This offers another obstruction to the follicular elements in their progress toward the surface and complete maturation, the result of which is dysmenorrhea. Such a continued state can give rise to but one symptomatology. To establish the proper circulatory relations within the uterus and ovaries, correction is necessary. When this is done, if the changes have not advanced too far, the ovaries are capable of reëstablishing their function. If they already have reached a degree of pathology where there are various multicysts on the surface, or where the tunica is immensely thickened, some surgical procedure will have to be used upon the ovary in order to favor the proper maturation of the follicles.

1. Operative procedures alone give a small percentage of successes.

2. Operative procedures sometimes add a troublesome pathological condition of the genital organs to the symptom-complex of dysmenorrhea and sterility.

3. The only intelligent method of studying the activity of the spermatozoa is in their relation to the female secretions

4. Ductless gland therapy is at present in its embryonal stage. While the writer fully appreciates the dangers of the indefiniteness of this therapy, he does feel after careful consideration of a series of cases, of which those quoted are a type, that further experience with endocrines will tend to clarify our present position in regard to the treatment of dysmenorrhea and sterility.

Delivery by the Natural Passages Following Cesarean Section. JOHN T. WILLIAMS, Boston. *American Journal of Obstetrics.* October, 1919.

After a review of the literature on Cesarean scars, there seems to be definite authority for allowing patients to go into labor, after having undergone Cesarean section for previous pregnancies. The types of patients which may thus be permitted to go into labor, are those in whom the indication for Cesarean section no longer exists (eclampsia, placenta previa, etc); and those in whom the operation was done for failure of the natural forces. In the latter case, the patient should be allowed to choose between the operation and natural labor.

The author's conclusions are as follows:

1. Sufficient evidence has accumulated to justify the conclusion that the presence of a Cesarean scar in the uterus is not sufficient reason for repeated Cesarean section in the absence of any other indication.
2. Cases delivered by Cesarean section for a temporary indication (eclampsia, placenta previa, inertia uteri, abnormal presentations, etc.) may be delivered by normal labor with safety if the scar has healed without sepsis.
3. Such cases should, however, be delivered in a hospital where equipment for abdominal section is accessible if needed.
4. All Cesarean wounds should be approximated with the greatest care, in order that a firm scar may be obtained and such a scar is in all probability equal in strength to any part of the uterine wall.

The Diagnosis of Tuberculosis of the Kidney. DANIEL D. EISENDRATH, Chicago. *Southern Medical Journal,* November, 1919.

Eisendrath divides the cases of tuberculosis of the kidney from a clinical and diagnostic standpoint as follows:

1. Those cases in which the first symptom is more or less severe hematuria;
2. Those in which the symptoms of cystitis predominate;
3. Those in which symptoms exist which point directly to the kidney as the seat of trouble or there is a combination of renal and vesical symptoms;
4. Those with an apparently acute onset resembling through the presence of chills, fever and the local evidences, an ordinary pyogenic renal infection;
5. The so-called "silent" cases where there is loss of weight and strength, indefinite lumbar or abdominal pain and the presence usually of a tumor in the kidney region (cases of closed pyonephrosis); and
6. Those in which the appearance of a perinephritic abscess is the first symptom.

The most important data upon which to make a diagnosis of tuberculosis of the kidney are the following:

1. *Bladder Symptoms.*—(a) increased desire to urinate, at first often at night, but later diurnal; (b) painful urination, concomitant with the increased frequency, which gradually becomes more and more severe; and (c) incontinence or great irritability as the bladder involvement progresses, so that the patient is unable to control urination.

2. *Kidney Symptoms.*—There is either a dull ache or there are recurrent colicky pains on the affected side or on both sides in bilateral involvement. Enlargement of the kidney is a very unreliable finding. It may be absent altogether and the opposite kidney may be compensatorily enlarged. The same is true for tenderness over the diseased kidney. Rigidity is only found when there is an invasion of the perinephritic tissues.

3. *Fever.*—There is little as a rule unless there is a mixed infection present or a sudden retention.

4. *Urinary Findings.*—Pyuria may be present except in cases of closed pyonephrosis or in the early stage of mixed infection cases. Hematuria may be the first symptom or may appear with pyuria at intervals. Tubercle bacilli can be found in the urine in 80 per cent. of the cases by the Forssell or Crabtree methods.

5. *Cystoscopy and Ureteral Catheterization.*—This is the most important single method of diagnosis. Unless changes specific of tuberculosis are found in the bladder, it is best to suspend judgment until the urine obtained by ureteral catheterization has been studied by culture and staining method. Tubercle bacilli found in the urine obtained directly from the kidney constitute a very important factor in making the diagnosis.

6. *Pyelography and x-ray.*—These are very important and should be done as a routine in all cases if possible. They yield much information as to the changes in the renal pelvis and parenchyma.

Fulguration of Papillomata of the Ureter. [De l' Etincelage des Papillomes de l'Uretére.] G. MARION. *Journal d' Urologie,* September, 1919.

The diagnosis of papillomata of the ureter can often be made. The diagnosis is suggested when hematurea continue after the destruction of vesical polyp, particularly if the polyp was near the ureteral orifice. The location of a ureteral polyp, can often be determined by a ureteral catheter, if on introducing the catheter gently there is a flow of blood, which ceases and gives way to clear urine when the catheter is pushed further up. Polyp is also suggested, when there is a sudden flow of urine, due to an obstructive hemato-hydro nephrosis.

The treatment consists in fulguration. The electrode is introduced to the point at which it touches the polyp. The point may be previously determined by ureteral exploration. The author was able to cure two cases of polyp in the middle third of the ureter by this method. The location of the polyp is determined by the point at which there is clear urine, above the level at which bloody urine was previously obtained, or the point at which there is a sudden flow of bloody urine.

Epididymotomy Treatment of Acute Gonorrheal Epididymitis. BRANNON T. HUBBARD, Montgomery. *Southern Medical Journal,* October, 1919.

As a result of several months experience at Camp Pike, the author believes that in the moderate and severe cases of epididymitis, the best immediate and remote results are obtained by epididymotomy.

The operation is described as follows. An masion one and one-half to two inches in length was made in the anterior and upper part of the scrotum in the affected side and carried down to the tunica vaginalis. The point at which the tunica is reached is not always easy to recognize when the tunica is thickened and infiltrated, as often happens when the condition has lasted several days. The tunica vaginalis having been reached, it is then separated best by blunt dissection with Mayo scissors from the surrounding tissues and the scrotal contents with their enveloping tunic are delivered. The tunica vaginalis is then opened, care being taken not to injure the testicle as the tunica is often adherent to the testicle. However, in the first few days of the disease, there is more or less serofibrinous effusion present. The serous membrane having been freely opened and turned back, the inflamed epididymis is exposed.

In the first two or three days of the attack the epididymis is found greatly swollen, purplish-red in color, the process being chiefly in either pole, but often the whole epididymis is involved. Unless the inflammation is mild and subsides rapidly suppuration usually takes place. Occasionally an abscess forms, which discharges externally, but usually the pus is slowly absorbed, leaving the well-known area of induration.

With a cataract knife or the sharp point of a scalpel numerous incisions are made in the serous covering of the epididymis, through which a needle is introduced and passed through the epididymis. In early cases only bloody serum escapes. Later on, a few drops of thin pus and sometimes abscesses of various sizes are evacuated. It would seem that the best time to operate is in the first three days before suppuration takes place. By relieving the pressure within the epididymis the suffering of the

patient, which is most severe, is alleviated and suppuration and consequent obstruction of the canal are obviated. It may be argued that penetration of the epididymis may in itself do damage; but it seems logical to suppose that a clean puncture will heal with less chance of obstruction than that caused by the formation of an abscess. If thought necessary, a silk-worm gut suture is run through the epididymis as a drain. Hagner put in a drain and sewed the tunica back in its natural position. As pointed out to me by Major George Day, this leaves the chance of a future hydrocele, which is not unusual after epididymitis. To obviate this, the tunica is resected close to the epididymis and the edges stitched with fine catgut. The scrotum is then closed with three or four stitches of silk-worm gut, one or two drains of small rubber tubing or gutta percha being inserted and left for two days.

The advantages of the operation, are:

1. Immediate relief of the intense suffering;
2. Shortening of the disease;
3. Continuation of the treatment of the urethritis;
4. Less recurrence; and,
5. Less likelihood of sterility.

The Tyranny of the Wassermann Test. H. LISSER, San Francisco. *The Journal of Cutaneous Diseases,* November, 1919.

Lisser attempts to solve difficult problems that confront the practitioner, as to the relation of the Wassermann test to anti-syphilitic therapy. He lays particular stress on the fact that patients with negative Wassermann reactions often require treatment, while many cases in the tertiary stage with positive Wassermann reactions require no treatment. His conclusions follow:

1. A strongly or definitely positive Wassermann reaction is undoubted evidence of syphilis.
2. It is an invaluable aid in the diagnosis of syphilis, especially in those cases where physical diagnosis does not reveal positive evidence of the disease.
3. A negative Wassermann reaction means exactly nothing, (*a*) It does not prove the absence of syphilis, because negative reactions occur in cases urgently requiring treatment. (*b*) Therefore it cannot denote a cure in treated cases.
4. A positive Wassermann reaction means syphilis, but not necessarily active syphilis.
5. Once the diagnosis of syphilis (after the primary stage) is established, the patient should be properly treated from two to four years, depending on the stage of the disease and the severity of the lesions.
6. Treatment should be entirely independent of the Wassermann reaction because negative Wassermann reactions sometimes occur prematurely during treatment, while positive Wassermann reactions frequently persist long after clinical cure.
7. Once the diagnosis of syphilis is positively established, the fewer Wassermann tests done the better, for the peace of mind of both the patient and the physician.
8. The Wassermann test should be employed as an aid to clinical judgment, but not to supplant clinical common sense.

Life Expectancy after Gastric Ulcer Operations. DONALD C. BALFOUR, Rochester, Minn. *Annals of Surgery,* November, 1919.

From statistics in over 2,000 cases of gastric and duodenal ulcer, Balfour proves a very striking fact, *i. e.,* that in the first two years following operation for duodenal ulcer, the mortality is only that of the general population group, while after the second year, the mortality is actually less than in the general population group. His statistics illustrate in addition, a fact which has been generally recognized by surgeons, namely, that gastric ulcer is a much more serious condition than duodenal ulcer, not only from the operative standpoint, but from the standpoint of after-results, and that a patient with a gastric ulcer, shows as a rule much more evidence of impaired general health than the patient with duodenal ulcer.

The detailed summary of results is as follows:

1. The percentage of operative deaths in the hospital following operations for gastric ulcer was fully twice that following duodenal ulcer, but the percentage in both cases was very low considering the seriousness of the condition.
2. The mortality during the three years following the operation among persons operated on for gastric ulcer was three times as high as that among persons operated on for duodenal ulcer.
3. The mortality among persons operated on for gastric ulcer, decreases relatively after operation, but the data are not sufficient to determine the number of years which must elapse before the death rate is similar to that of the general population.
4. The mortality among those operated on for duodenal ulcer in this series was less than that among the general population.
5. The average age at the time of operation for gastric ulcer was 47 for men and 43 for women; for duodenal ulcer, 44 and 42 respectively.

Empyema. J. STEWART RODMAN, Philadelphia. *Pennsylvania Medical Journal,* November, 1919.

Rodman sums up his experiences with the post-influenzal empyemas, that occurred at Camp Bowie and at Ft. Ogelthorpe. He refers only to those cases due to the hemolytic streptococcus, following influenzal pneumonia. His treatment follows in the main, the principles of surgical treatment elaborated during the epidemic, viz., repeated early aspirations and operation only in the later stages after the development of frank pus. The technic when operation was necessary, was as follows:

Wide resection, 2 to 3 inches of the eighth or ninth rib in the posterior axillary line; introduction of four Carrel tubes, two upward and two downward, each tube having twenty perforations; immediate irrigation with 0.5 per cent. Dakin's solution (full strength) on the table, leaving the wound wide open and packing with gauze soaked in Dakin's solution, tight enough to steady the tubes, and protecting the surrounding skin with sterilized vaselin. A rather voluminous dressing is then placed over the wound and the patient returned to bed. Instillation of 100 c.c. Dakin's solution every two hours by the nurse and irrigation daily at the dressing complete the procedure. The results of this treatment were striking; the toxemia almost immediately disappeared; the character of the discharge became less purulent almost from the start. The Dakin's solution dissolved out the large fibrin masses and the wound could usually be closed after such chemical sterilization in from ten days to three weeks. A normally expanding lung remained and the soldier returned to full duty. The marked shortening of the convalescence and the early return to duty were certainly worth the extra trouble which this technic entails.

Pulse Pressure in Traumatic Cerebral Compression. HARRY M. ARMITAGE, Chester, Pennsylvania. *The Pennsylvania Medical Journal,* November, 1919.

As a result of investigations conducted in a large number of cases of cerebral compression due to trauma, the author presents the following conclusions in reference to the blood pressure findings in this type of case.

In severe fractures of the base with widespread hemorrhage, the blood pressure symptoms are valueless.

In traumatic cerebral compression where the local symptoms suggest a blood clot or a depressed fracture pressing on the brain as evidenced by roentgen ray, palpation or paralysis, the general symptoms such as slowed pulse and blood pressure findings may be of little value if the medulla is not involved by pressure. Operation is the only rational treatment in these cases.

In cases with major symptoms of choked disk, headache, disturbed sensorium, coma, increased pressure of the cerebrospinal fluid as registered by the spinal mercurial manometer, and slow pulse, we invariably find a high pulse pressure.

The systolic pressure is too uncertain a factor to be of any value whatever in diagnosing the amount of pressure.

Decision as to whether a patient should be trephined should be determined after grave reflection and consideration of the entire group of symptoms, but in all cases of head injury frequent estimations of the pulse pressure and pulse rate should be made.

The issue is unmistakable.

The subject has passed out of the realms of thought and presents itself as a clean-cut fact.

Where we have an increasing pulse pressure and a falling pulse, an operation should be performed without any delay, in traumatic cerebral compression.

Roentgenography of the Brain after the Injection of Air into the Spinal Canal. WALTER E. DANDY, Baltimore. *Annals of Surgery*, October, 1919.

Dandy presents an interesting series of plates, and experiments, which undoubtedly will offer a distinct aid to the diagnosis of diseases of the cord, brain, and appendages. A small quantity of fluid is withdrawn and an equal amount of air, injected into the spinal canal. This process of substitution is repeated until the fluid ceases to appear on aspiration. The head of the patient must be elevated at least 20% above the needle. This position allows the fluid to descend to the level of the needle as the air is injected.

As a result of these experiments, the following points were clearly brought out:

1. By substituting air for cerebro-spinal fluid through a lumbar puncture, all parts of the sub-arachnoid space can be clearly seen in a roentgenogram.
2. Not infrequently, an air shadow, will completely surround the cerebellum, showing clearly its size and shape.
3. The spinal cord can be seen, surrounded by a column of air.
4. The cisternae appear as large collections of air at the base of the brain, the cerebral sulci as a network of tortuous filaments of air.
5. After an intra-spinous injection of air, provided that the sub-arachnoid space is intact, the air will fill the cerebral sulci.
6. But if the cisternae are blocked at any point by tumor or adhesions, the air will not be able to reach the cerebral sulci.
7. The exact position of the obstruction in the cisternae can often be seen in the radiogram. In one of the cases of communicating hydrocephalus the obstruction was in the cisterna pontis. In a second case of communicating hydrocephalus the cisternae were patent, but all except one or two of the main branches were occluded. In a third case a tumor was located in the midbrain solely by the means of the radiogram.
8. In a case of hydrocephalus, air passed from the spinal canal into the lateral ventricle, demonstrating the patency (and dilatation) of the foramina of Magendie and Luschka, the aqueduct of Sylvius and the foramen of Monro.
9. A case of hydrocephalus was cured by constructing a new foramen of Magendie. Six weeks later, air injected into the ventricles passed through the new foramen, showing that it was still functioning. The air also filled the cerebral sulci showing that the entire arachnoid space was patent.

A Study of Autopsy Records. C. B. S. GIBBS, Syracuse. *New York Medical Journal*, November 15, 1919.

Gibbs has analyzed the autopsy findings in over 160 cases of head injury, and has correlated these with the etiological factors and symptoms. From this study, several inferences can be drawn, as indicated in the following conclusions.

1. Traumatic injury to the brain of sufficient severity to cause death may occur without fracture of the cranium.
2. Fractures of the skull in children tend to be more localized and less radiating than in the adult.
3. In the series of cases studied, in order of frequency, the vault and base together rank first, the base alone second, and the vault alone last.
4. Fracture of the anterior fossæ occurred more frequently in this series than fracture of the other fossæ.
5. Fractures may often be seen or felt in a scalp wound, or may be exposed by enlarging the wound, or by exposing the cranium beneath the area of traumatism.
6. Fractures usually start at the point of impact and tend to travel downward to the base, not being deflected by sutures.
7. In fifty-nine per cent. of cases of fracture of the middle fossæ hemorrhage from the ear was observed to have occurred.
8. Subconjunctival hemorrhage may be present without fracture, and absent in cases of fracture of the anterior fossæ, but in the majority of cases it indicates fracture of the anterior fossæ across the orbital plate.
9. Injury to brain tissue may occur at the pole of the brain opposite the point of impact.
10. Laceration of the brain occurred in twenty-eight per cent. of the cases.
11. Meningitis occurred in 10.9 per cent. of the cases, and in the majority of these the streptococcus was found.

Operations for Acute and Sub-Acute Mastoiditis: Results in a Series of Sixty-Five Cases. I. H. LILLIE and R. A. BARLOW, Mayo Clinic, Rochester, Minn. *The Journal-Lancet*, November 1, 1919.

The indications for surgical treatment in mastoiditis are as follows:

1. Displacement of the auricle outward without furunculosis, which always means invasion of the soft parts over the mastoid cortex.
2. Discharge persisting for more than five weeks without a tendency to subside. Such a condition, except in young children, invariably means involvement of the mastoid, even though there is no pain over the mastoid. Such an ear, if untreated, becomes the chronic discharging ear. Usually, in this type there is more or less night pain.
3. Marked mastoid tenderness and pain which does not diminish in a few days following free drainage of the middle ear. We have all seen cases which appeared definitely surgical before paracentesis, in which the patients get well following free paracentesis; middle ear drainage should, therefore, be used first.
4. Development of symptoms of sepsis after ruling out other possible factors, such a pyelitis in little girl patients, central pneumonia, and conditions that might cause a septic type of temperature. If the patient has acute otitis, and if there is involvement of the sigmoid sinus, well-directed surgical interference is imperative.
5. Development of symptoms of meningitis in the presence of otitis.
6. Development of symptoms of labyrinthitis in the presence of acute otitis.

From a study of the results in these cases the authors conclude that:

1. In case of definite mastoiditis operation is indicated reasonably early. The mortality is practically nil.
2. Preservation of the hearing function is fairly certain.
3. A second operation should not be necessary, except for a complication, such as sinus thrombosis or brain abscess.

Operation for Fistula in Ano Without Division of Sphincter (Elting), With Report of Cases. G. T. TYLER, Greenville, S. C. *Southern Medical Journal*, October, 1919.

Tyler reports gratifying results in operations for fistula in ano without division of the sphincter.

To those familiar with the Whitehead operation for hemorrhoids, this one will not be difficult. The fistulous tract is located, the sphincter well dilated, and the bowel circumscribed at the muco-cutaneous junction. It is dissected freely, beyond the internal opening of the fistula, until the healthy gut can be brought down for suture to the skin. That part below the fistula is removed and the bowel attached to the skin by interrupted silk sutures. A rectal plug is inserted to prevent oozing. The external opening of the fistula is enlarged, the tract curetted, and a small drain inserted for three or four days. In two weeks most fistulas are healed, though some require much longer. longer.

In one case the procedure was modified. Here the in-

ternal opening was just within the external sphincter. By dissecting the bowel on the side of the fistula, the other side being quite normal, a complete Whitehead operation was not performed but Tyler was able easily to bring down enough bowel to free the internal opening of the fistula, and to suture on one side without disturbing the other. The outcome in this case was very good.

Book Reviews

Colloids in Biology and Medicine. By PROF. H. BECHHOLD, Member of the Royal Institute for Experimental Therapeutics in Frankfurt a/M. Authorized Translation from *The Second German Edition,* with Notes and Emendations by JESSE G. M. BULLOWA, A.B., M.D., Assistant Clinical Professor of Medicine, Fordham University. Octavo; 435 pages; 54 illustrations. New York: D. VAN NOSTRAND COMPANY, 1919.

The translation of Prof. Bechhold's book is most timely, as the growth in interest in colloids has been rapid, and adequate volumes upon the subject have been lacking. The work of the translator has been excellently done and the general contents of the volume has been enriched by his numerous annotations and references to American literature.

The introduction deals with the nature of colloids, their physical properties, the phenomena of colloids, and the method of colloid research; the second part deals with the biocolloids as carbohydrates, lipoids, proteins, and enzymes. A valuable chapter is devoted to immunity reactions.

Part three undertakes a discussion of the organism as a colloid system, and discusses metabolism, the nature of the cell, problems of circulation and respiration, secretion and excretion, absorption together with a most suggestive chapter on toxicology and pharmacology.

From the standpoint of illustration and exposition, the needs of the student are amply supplied, and a subject that is essentially technical is presented in a most readable and graphic manner. Credit must be divided between the original writer and the translator, whose ability has made this subject valuable to the English reading public. As an authoritative volume, it is to be unhesitatingly recommended, and merits consultation by all investigators into the problems of colloidal medicine.

Problems of Fertilization. By FRANK RATTRAY LILLIE, Professor of Embryology, University of Chicago. Duodecimo; 278 pages; illustrated. Chicago: THE UNIVERSITY OF CHICAGO PRESS, 1919.

This little book is an epitomé of the work done to clarify the subject of fertilization. It is a clear and very readable exposition unusually free from unnecessary technicalities, and it can be highly recommended to any one desiring to obtain a general view of this interesting field. The treatment is also sufficiently complete to interest the medical public and specialists in biology.

Lillie has incorporated a large amount of his own researches which tend to show that fertilization is due to the action of a substance which he denominates "fertilizin." This substance exerts an agglutinating action on the spermatozoon and likewise an activating action on the egg. In terms of the side chain theory "a three body reaction takes place between the sperm receptors, fertilizin and the egg receptors linked in line." Considerable discussion of Loeb's theory of activation will be found throughout the book and Lillie's thesis may be considered a defense of his own views.

In a review it is impossible to even touch upon the many interesting details (morphological, physiological, biological and physico-chemical) which are dealt with The fields of sterility, hybridization, inheritance, compatibility, etc., are trenched upon.

This book should be read with special interest by genito-urinary, gynecological and obstetrical specialists who will gather from its pages many new ideas relating to the fundamental principles which control and govern fertilization, even though only the lower forms of animal life are considered.

Menders of the Maimed. The Anatomical and Physiological Principles Underlying the Treatment of Injuries to Muscles, Nerves, Bones and Joints. By ARTHUR KEITH, M.D. (Abdn.), F.R.C.S. (Eng.) LL.D. (Abdn.), F.R.S., Conservator of the Museum and Hunterian Professor, Royal College of Surgeons, England. Small octavo; 335 pages; illustrated. London: HENRY FROWDE, HODDER & STOUGHTON. OXFORD UNIVERSITY PRESS, 1919.

In this book, Keith has attempted something quite novel. He has expounded the fundamental principles underlying orthopedic surgery from the historical point of view. In orderly succession, he takes up the lives of those who have made orthodepic surgery what it is, explaining the contributions of each and tracing the development and modifications of each principle in successive thoughts and practice. Thus Keith begins with John Hunter who insisted upon the power of nature to heal and who formulated the principle of rest in the healing of injury. He passes to Hilton, Thomas, Marshall Hall, Duchenne, Duhamel, Ollier, Sayre, Wolff, etc. Chapters are devoted to tenatomy, bone growth, muscle and nerve transplantation, degeneration of nerves, gymnastics and massage, bone grafting, etc. The book is more than a mere history of orthopedics. It is a masterly exposition and summary of all the great problems underlying orthopedic surgery in the light of our present understanding. It is therefore a work of reference as well as a history.

Vicious Circles in Disease. By JAMIESON B. HURRY, M.A., M.D. (Cantab.) Author of "Poverty and Its Vicious Circles," etc. *Third Edition.* Octavo; 377 pages; with diagrams. Philadelphia: P. BLAKISTON'S SON & Co., 1919.

Familiarity with vicious circles in medicine is recognized by clinicians and pathologists as the basis of understanding disease cycles. Dr. Hurry presents in his monograph, an excellent résumé of present-day knowledge concerning the biological interactions common to all organized tissues. In the third edition particular stress has been placed upon methods of breaking the vicious circle through the administration of drugs, the use of hygienic measures, the application of mechanical supports and the employment of surgical procedures.

The aim of the volume is distinctly practical, seeking to raise the standards of diagnosis, prognosis, and treatment through a keener insight into organic interdependence and the reciprocal influence of organic dysfunction.

The descriptive text, supplemented by excellent though simple diagrams, serves to illumine our understanding of the mechanism of disease processes in the light of physiological and pathological action.

Books Received

Wade in, Sanitary! The Story of a Division Surgeon in France. By RICHARD DERBY, Lt.-Col., M.C., U.S.A., Division Surgeon, Second Division. Duodecimo; 260 pages; illustrated. New York and London: G. P. PUTNAM'S SONS, 1919.

The Exact Diagnosis of Latent Cancer. An inquiry into the True Significance of the Morphological Changes in the Blood. By O. C. GRUNER, M.D., Leeds. Author of "Biology of the Blood Cells," "Studies in Puncture-Fluids," "A Code System in Pathology," etc. Octavo; 79 pages; illustrated. Philadelphia: P. BLAKISTON'S SON & Co., 1919.

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January 1919

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RECENT STUDIES IN POSTOPERATIVE PNEUMONITIS.*

ALLEN O. WHIPPLE, M. D.,
NEW YORK CITY.

During the past three years an intensive study has been carried on in the Presbyterian Hospital, New York City, in postoperative pulmonary complications. In particular, more attention has been paid to Postoperative Pneumonitis. This has been carried on along three lines,—clinical, bacteriological and Roentgenological. During these three years, there have been 160 cases of Pneumonitis observed in the surgical service, an incidence of 2.4 per cent. This rather large number of cases is due undoubtedly to the fact that a vigilant lookout has been kept on every postoperative case showing any signs or symptoms of a pulmonary complication.

In practically every admission to the surgical service in the years 1916 and 1917, a preoperative bacteriological examination of the sputum by means of mouse inoculation was carried out. Any case developing a pulmonary complication had a postoperative examination made of the sputum for comparison with the preoperative, and every case developing signs or symptoms of a pulmonary complication was radiographed to determine the presence of a shadow in the lung plate. Daily notes and examinations of the chests were recorded and in this way far more attention was paid to the determination of the complication than is customary in most hospitals.

The fact that the usual type of postoperative pneumonia is a Pneumococcus IV lesion, short in duration, terminating by lysis and frequently without any marked subjective symptoms, accounts for the large number of cases that are overlooked in the majority of surgical services. The sudden rise in temperature which so frequently accompanies this complication and which usually appears within the first forty-eight hours, is usually spoken of as *postoperative reaction* and unless the careful examinations mentioned before are made in these cases, the true nature of such reactions is not determined.

There are many phases to the problem of postoperative pneumonitis and these have been discussed at some length in the author's paper on "Postoperative Pneumonitis" in *Surgery, Gynecology and Obstetrics,* Vol. XXVI, January, 1918. Briefly the factors associated with the complication may be defined as follows:

*Read during the Sixth Annual Meeting of the American Association of Anesthetists, Auditorium Hotel, Chicago, Ill., June 10-11, 1918.

A.—PREDISPOSING FACTORS.

1. Season.—The complication is much more common in the winter and early spring months and the incidence curve corresponds to that of medical types of pneumonia.

2. The presence of a concurrent inflammation or the history of a recent inflammation of the upper respiratory tract, such as coryza, pharyngitis, tonsilitis, laryngitis and bronchitis.

3. Exposure of patients to changes in temperature, or currents of air during the admission routine of bathing, preparation for operation, enemas and the exposure of patients during or at operation to moisture, currents of cold or damp air and sudden changes in temperature.

4. Inhibition of the respiratory movements, especially abdominal respiratory movements, the result of the abdominal incision with its accompanying pain and tenderness and postoperative distention, and tight binders.

5. Cyanosis during or immediately after the operation, resulting in pulmonary congestion.

6. An improperly given general anesthetic, permitting mucus accumulation in the pharynx, with improper position of the head and obstruction of a free air passage.

The relaxed palate and posterior position of the tongue, evidenced by stertorous breathing, causes a churning of the mucus and this results in a freeing of bacteria from the crypts of the tonsils in the oropharynx. Experiments have shown that sputum specimens coughed up from the larynx before operation show relatively few or no pneumococci, whereas mucus aspirated from the glottis after an hour of anesthesia shows countless numbers of pneumococci when injected into mice. This is particularly true of the Pneumococcus IV which are saprophytic in the majority of the throats of healthy individuals during the late winter and early spring months.

B.—EXCITING CAUSES.

Bacteriologically the Pneumococci IV have been found in some 50 per cent. of the cases developing a pneumonitis, either in preoperative or the postoperative specimens of sputum. Pneumococcus of the four groups was recovered in some 70 per cent. of the cases in postoperative pneumonitis. From serum agglutination tests and from the urine precipitin tests as well as from the mouse inoculation studies of pre- and post-operative sputum, it is safe to say that the great majority of postoperative pneumonias are caused by the Pneumococcus IV. These bacteriological observations agree with the clinical findings which show that these pneumonias

are of short duration and of relatively low mortality, corresponding in a general way to the atypical group IV pneumonias which are seen in the medical wards.

PROPHYLAXIS.

The predisposing factors give the clue to the prophylaxis in dealing with the complication. During the winter and spring months especially, patients should not be operated upon, unless there is no choice, where there is a history of recent or concurrent cold. Eliciting this part of the patient's history is almost invariably neglected in the average hospital. More attention should be paid to the stay in the hospital, especially immediately before, during and the first two or three days after operation. Too much of this part of surgical treatment is left to inexperienced nurses and orderlies.

Counter-irritation of the chest, immediately following operation is of value in combating the initial pulmonary congestion. A preliminary treatment of the throats of patients during the 12-24 hours preceding operation by means of 2 per cent. Dichloramine T in Chlorcozane, according to the method of Dunham and Dakin in their treatment of meningococcus carriers in the army, is now under investigation in the Presbyterian Hospital, but not enough cases have been tried to draw definite conclusions. The rationale of the method in temporarily reducing the pneumococcus and other pathogenic bacteria in the oropharynx is certainly sound, and the method should give good results.

As regards the anesthetic, the complication followed after operations under ether, chloroform, gas-oxygen and local anesthesia, where no general anesthesia of any kind was used. This is definite proof that no one general anesthetic is the exciting cause and the complication should not be called an ether pneumonia nor an anesthetic pneumonia. The complication in a patient having a cold or an upper respiratory tract inflammation is more apt to follow ether anesthesia and the author believes that this is due to the fact that ether is more irritant to an inflamed oropharynx and mucus accumulation is more liable to occur in these cases. It is the churning of the mucus in such a throat, with the saturation of this mucus with pathogenic organisms, especially the pneumococcus, that makes the patient more liable to descending infection of the bronchi. This tendency to mucus accumulation is of course largely dependent upon the lack of skill in administering the anesthetic, especially during the induction stage and the failure to maintain a smooth and even degree of anesthesia. It is a well recognized fact that the complication is found less frequently in cases anesthetized by experienced and skilled physicians. It is, however, the duty as well as the natural inclination of the modern expert anesthetist, to fit the anesthesia to the patient, and to use, if possible, chloroform or gas oxygen, where a general anesthetic is required in a case giving the history or signs of a concurrent inflammation of the respiratory tract, rather than to adhere to the narrow rule of using ether for all cases.

The management of the head and the jaw and the depth and evenness of anesthesia need not be emphasized to such a gathering as this, for during the maintenance of anesthesia, the skilled anesthetist plays his part well. It is the period immediately after operation, while the patient is regaining his laryngeal reflex and is recovering from the anesthesia, that is too often left to the management of inexperienced members of the nursing and hospital staff. How frequently does one see a patient leaving the operating room on a stretcher in the dorsal position, cyanotic and gurgling or stertorous, perhaps vomiting, while the nurse tries to keep the jaw forward, but seems unaware of the fact that the oropharynx is blocked with secretions.

Dr. Thomas L. Bennett of New York, in his wonderfully instructive discussions on anesthesia has for many years emphasized the importance of keeping the patient turned on his side while on the stretcher and for the first few hours after operation. This position is always an easy one to maintain, the head can be held on the side in a natural and easy manner, the air-passages are free and the patient does not aspirate pneumococcus laden sputum, to say nothing of vomitus. To the mind of the author, this one precaution is the most valuable of any that has been suggested, and since making this a rule at the Presbyterian Hospital, pneumonia incidence has definitely decreased. The prevention of the aspiration of pneumococcus laden sputum, by whatever means, is the most important measure that can be employed by the anesthetist, and he should constantly endeavor to see to it that this is carried out, both in and out of the operating room. Other measures, but of less importance, following operation, are breathing exercises, the Gatch or Fowler positions and the frequent turning of patients, especially the feeble and aged ones, the use of counter-irritation to the chest by means of a mild rubifacient, Prevention of aspiration of oropharyngeal secretions and pulmonary congestion, and re-establishing the relatively normal aeration of the lung, should be the aim of surgeon and the anesthetist in dealing with the problem of Postoperative Pneumonitis.

DISCUSSION.

DR. JOHN W. SEYBOLD, Denver, Col.:—Dr. Whipple did not emphasize sufficiently the danger of postoperative pneumonia precipitated by unqualified anesthetists. If the incidence of postoperative pneumonitis is so great in a hospital supplied with skilled anesthetists, what must it not be in institutions employing non-medical and unskilled persons as anesthetists. It is no wonder such hospitals lack the courage to publish their records. If surgeons really wish to protect their patients, as well as their statistical records, they should secure the most competent anesthetic service available and see to it that their anesthetists are not only licensed and qualified physicians or dentists, but that they are expert in their work and interested in providing exceptional service. While making the rounds of various clinics during this Chicago meeting I was not only impressed with the large number of non-medical persons giving anesthetics, but I was even more surprised at their almost entire lack of skill and knowledge. Judging by what I saw I would have no hesitation in saying that the incidence of postoperative pneumonia, as well as other untoward anesthetic effects, must be very great in these clinics. What purports to be the open drop-method of etherization, in the hands of these non-medical anesthetists, degenerates into a dousing with ether, irrespective of the patients conditions or the requisite depth of anesthesia necessitated by the operation. All patients are carried to and beyond the point of ether depression. Surgeons who are satisfied with such anesthesia, because it masks the trauma of their style of operating, have as yet to learn the advantages of the velvet touch, joint preparation and after-care as well as a depth of anesthesia just sufficient to overlap the necessary reflexes of the operative procedure without unnecessary and always dangerous ether saturation.

DR. RALPH M. WATERS, Sioux City, Iowa:—In reading a paper, recently, before the Iowa State Medical Association, I had occasion to allude to the use of the non-medical anesthetists as a result of false economy, or necessity because properly trained and efficient medical anesthetists were not everywhere available. A surgeon in discussing my paper acknowledged that he had taken up local anesthesia to protect his patients from the disastrous effects of incompetent anesthesia especially by half-trained non-medical persons. If we are to eliminate postanesthetic complications it is vitally important to put enough qualified anesthetists into service not only to meet the demand for them, but to protect the public from the results of incompetence.

DR. ISABELLA C. HERB, Chicago, Ill.:—The incidence of postoperative lung complications seem to be greater after certain operative procedures rather than certain methods of anesthesia if properly employed. Thus septic cases are most prone to develop postoperative pneumonias. Next in order follow operations on the stomach and gall-bladder, probably on account of partially suppressed pulmonary ventilation. We are very careful in maintaining body heat during operation and in preventing exposure of the operated patient at any time. As our method of drop-ether does not produce mucous secretion it is not an appreciable factor in causing inspiration pneumonitis.

DR. E. I. MCKESSON, M. D., Toledo, Ohio:—Conservation of body heat before, during and after operation is essential in the prophylaxis of postoperative lung complications. An operating room temperature lower than 80° invites trouble and I have repeatedly refused to give anesthetics to patients for operations in operating rooms not sufficiently heated. The most difficult period of the year is between seasons when adequate heat is not always obtainable. The patient should also be protected from methods of anesthesia which produce profuse sweating, as in this condition, exposure, while being returned through draughty corridors or being put back to bed, induces cutaneous shock and results in pneumonia. In Toledo the frank postoperative pneumonias are confined to one hospital, where they occur in the spring and fall and are no doubt due to a cold operating room.

DR. WM. HAMILTON LONG, Louisville, Ky.:—All anesthetic apparatus should be thoroughly cleansed before being used on another patient, especially when, in the previous case, mucous secretion has been profuse. There is in a lack of cleanliness and sterilization the danger of transmitting pulmonary infection. Patients can best be protected from exposure by being wrapped in warm blankets before leaving the operating room and they should always be returned to a previously warmed bed.

DR. W. B. HOWELL, Montreal, Canada:—Dr. Long's point is important, but difficult to put into effect in casualty clearing stations. Surgeons and anesthetists often have to work in sweaters and no heating facilities are at hand to raise the temperature of the operating theater. Add to these inconveniences the effects of rain and mud and it is obvious that postoperative pneumonia should be prevalent in casualty clearing station surgery. It is, however, extremely rare, although mucus hypersecretion is the rule on account of the fact that so many of the soldiers have what is know as a Flanders cough. I cannot explain the infrequency of postoperative pneumonitis unless it is because the soldiers have become hardened by exposure.

DR. E. M. SANDERS, Nashville, Tenn.:—Oral prophylaxis is absolutely necessary in the preparation of patients for safe anesthesia and successful surgery. In our clinic we find about 90 per cent. of the patients coming to operation have pyorrhea, while some 25 per cent. have actually foul mouths. It is now our invariable custom to have the mouths of all such patients put into proper condition previous to operation and our incidence of postoperative pulmonary complications has materially decreased.

DR. J. A. ZARROCKI, Chicago, Ill.:—Six years intensive work in cleaning-up the mouths of patients with pyorrhea and abcessed teeth, enables me to verify and emphasize Dr. Sander's contention that oral propylaxis plays an important part in the prevention of postoperative pneumonitis. Microscopically foul mouths show the presence of staphylococci, streptococci and pneumococci and it is quite conceivable, how when they are churned out of pyorrhea pockets or abcess cavities and swallowed with the hypersecretion of mucus, an infection is set up.

DR. RILEY, Havana, Cuba:—While we have many cases of lobar pneumonia in Cuba, we do not have postoperative pneumonia. We use chloroform, of course, but our patients are not chilled nor is there hypersecretion of mucus.

DR. MOSES SALZER, Cincinnati, Ohio:—In connection with the role of ether as a factor in causing postoperative pneumonitis, it is of interest to note the fact that Dr. W. E. Savage is now using the closed method of etherization in the treatment of pulmonary and other form of tuberculous infections with surprisingly good results. Dr. Thad Reamy, the pioneer gynecologist of the Ohio Valley always taught that etherization was a specific cure for bronchial conditions.

CONDITIONS PERMITTING EVERY EFFORT WILL BE MADE TO HOLD THE REGULAR MEETINGS OF THE AMERICAN AND INTERSTATE ASSOCIATIONS OF ANESTHETISTS. IT IS HOPED THAT MANY OF THOSE NOW IN SERVICE WILL BE DEMOBILIZED IN TIME TO ATTEND AND TO PRESENT SOME OF THEIR INTERESTING AND VALUABLE OBSERVATIONS ON ANESTHESIA IN WAR SURGERY AND THEIR PERSONAL EXPERIENCES AT THE FRONT. UNDOUBTEDLY CONSIDERABLE DATA HAS BEEN DEVELOPED BEARING ON THE EFFICIENCY OF CERTAIN METHODS OF ANESTHESIA FOR EMERGENCY SURGERY THAT SHOULD BE OF IMPORTANCE TO CIVILIAN AS WELL AS WAR SURGERY.

NITROUS OXID-OXYGEN ANALGESIA IN NORMAL LABOR AND OPERATIVE OBSTETRICS.*

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EVANSTON, ILL.

In October, 1917, I reported in a paper which was published in the *American Journal of Obstetrics,* the results of the use of gas as an agent for the production of analgesia in a series of 476 cases. This series of cases covered the work which we had done with gas for this purpose from March, 1915, until the first of February, 1917. Since the termination of this series of cases, reference to the hospital records show that up to May first of this year we have used gas as an analgesia in 187 further cases, the sum of these figures giving us a series of 663 cases in which we have had the opportunity to observe the value of this method of relieving pain. The cases which make up this series comprise the private cases of members of the attending staff of the hospital; the cases of the ward service, and also those which were brought in from time to time by outside physicians.

The administration of gas in all cases was done by our permanent staff in the obstetrical division, hence a uniform technic was maintained, rendering all cases available for statistical study. Our technic is quite simple. The administration of gas is begun in primiparæ at or a little before the termination of the first stage. In multiparæ it is usually begun a little before the completion of the first stage. We try in so far as possible, not to administer gas for a longer period than three hours, as there appear to be theoretical objections for its longer use. In our earlier work we had a considerable number of cases which ran over a longer time than this without any untoward experience. However, the period of three hours covers in a great majority of cases the time of greatest suffering.

In cases in which a long and tedious first stage is anticipated, much relief may be obtained from the use of morphine hypodermically. The actual administration is carried out by one of the permanent staff of graduate nurses who has become familiar with the administration of analgesia, or by an interne who has had some experience with it.

The gas is begun immediately at the onset of a pain, if possible before the contraction becomes apparent to the patient as pain. The patient is asked to breathe deeply and quickly the number of breaths which are needed, varying in different cases. During the second stage if the obstetrician will keep a hand upon the sterile sheet covering the abdomen, he may often feel the beginning of the contraction before pain is apparent to the patient, and request the anesthetist to commence the administration of gas instantly. Failure to observe this rule of exceedingly early administration militates very seriously against success in gas analgesia.

I believe that slowness in beginning the administration of gas after the onset of pain is responsible for more failures to relieve suffering than any other one factor. Each patient is to some extent a law unto herself as to the exact amount of gas which may be needed. Some will obtain a very satisfactory degree of relief from pain with three or four breaths while others find it necessary to take more. We have found in some cases that it was necessary to give gas throughout the entire extent of the pain.

The percentage of gas varies somewhat in different patients. In some cases gas alone has been used, but the administration of nitrous-oxid unaccompanied by oxygen should be permitted only where a small number of breaths are necessary to produce analgesia. Oxygen may be added in percentages varying from 5 to 15, according to the individual necessities of different patients, but the average case does very satisfactorily with 5 to 7 per cent. The exact number of breaths to the percentage of oxygen must be determined by the operator shortly after the beginning of the administration of gas, and, having determined what is necessary for the relief of pain in the individual patient, one should continue to administer it in the same way. *Rebreathing is not permitted at any time while the child remains within the uterus.*

It is very necessary to distinguish between analgesia and anesthesia. Patients should not be permitted to pass beyond the zone of analgesia. Should this be permitted, we lose the coöperation of the patient and struggling becomes more likely than if it is not done. Cyanosis must absolutely be avoided and in the hands of a competent anesthetist may be prevented.

As the end of the second stage is approached, we permit a little more gas with each pain and at the time of delivery, for the last three to five pains, I have been for some time in the habit of adding a little ether through the gas machine. I find that this promotes relaxation, makes it more easy to control the head, and delivery may be ac-

*Read during the Sixth Annual Meeting of the American Association of Anesthetists, Auditorium Hotel, Chicago, Ill., June 10-11, 1918.

complished without the patient being at all conscious of it.

Episiotomy may be done at this time with the slight addition of ether without any appreciation of pain. Ether given in this way and for so short a time does not produce narcosis of any length and the patient rapidly awakes and only very rarely has any nausea.

As to the results which we have been able to attain by the technic just described, I will quote from the report which I have referred to above in the *American Journal of Obstetrics* in which in 476 cases, it was found that unsatisfactory results were attained in 7½ per cent. References to the history sheets in the 187 cases which we have had since the publishing of that report show that successful relief of pain is being attained in fully as high a percentage of cases at present.

We have so far not had a case of fetal death in which the death seemed fairly chargeable to gas. There has in every instance of still-birth been some other competent cause for the loss of the child. Of the 476 cases which I have already referred to, 32 babies were born asphyxiated to a greater or less degree. The histories of these cases show that in 12 of them some reason other than anesthesia existed which might be looked upon as responsible for the asphyxia. In 7 of these cases forceps operations had been done. One was a breech extraction, one threatened eclampsia and one child had a spina bifida and lived but three days. One case was a severe toxemia of pregnancy and one a premature labor. We have therefore 20 cases which may be looked upon as having shown more or less asphyxia.

Since beginning the use of gas we have not observed that hemorrhage of the new-born has increased in frequency. There have been a number of cases of hemorrhage of the new-born, but it is quite striking that some of the most serious of these have been cases which had received gas but a very short time. It should be remembered by the anesthetist, however, that asphyxia will cause hemolysis without regard to what may be the cause of the asphyxia, hence cyanosis must be avoided and, since its avoidance is largely dependent upon the development of a proper technic, there is little excuse for its occurring. It seems also to be a fact that anesthesia to the point of unconsciousness with any anesthetic may produce certain changes of cell structure and hemolysis may be looked upon as more likely, but with the proper gas technic, unconsciousness should not occur except at the end of labor and for a very short time.

When the use of gas as an agent for the production of analgesia was first begun there was a tendency by some to emphasize the point that its administration was exceedingly simple and to give the impression that it might be done by any one. As my experience with it has grown I have gone farther and farther from that point and at present am inclined to disagree with it absolutely. A properly given analgesia does require a certain amount of technic and it has been my experience that the advent of a new interne in the obstetrical division has usually been followed by a period of poorly given analgesias; since then we have tried to train each one of them somewhat in its use.

I have had no experience with the method of self-administration, that is, the permitting of the patient to start the flow of gas herself by means of a spring valve which she presses upon, and which closes should her finger become relaxed through too deep an influence of gas. I prefer much to have the administration of analgesia under the observation of a competent person.

After an experience of about three years with the opportunity of observing the use of gas analgesia in a number of cases referred to in this report, I feel that this method has given us the best results which we have yet been able to attain in our maternity.

The administration of gas does not diminish either the frequency of the uterine contractions nor the force of the individual contractions. In fact, as the pain of the second stage is so largely done away with, we find that our patients are much more willing to make use of their accessory muscles of expulsion and that the labor is hastened instead of retarded. The intelligent patient with a properly given analgesia will coöperate perfectly, bearing down when requested and stopping immediately if asked.

It has been a matter of frequent observation that a patient who has been complaining bitterly of suffering toward the end of the first stage, perhaps even becoming a little unmanageable, will almost immediately become quiet and amenable to suggestion upon the beginning of gas administration. I feel also that we have been able to carry a number of cases through a tedious second stage where by reason of the fact that the patient was a nervous individual and one who bore pain poorly, the labor might have had to be terminated by high forceps. I can recall several of these which have gone on to the point at which a simple low forceps operation sufficed. This of course has its effect upon the lowering of fetal mortality as well as spar-

ing the mother the trauma of the high operation.

One other factor has impressed me greatly. That is, the relief from nervous exhaustion subsequent to labor by reason of the fact that the mother has passed through that portion of her labor which is accompanied by the greatest pain while under the influence of gas. I believe that the suffering which the patient undergoes is a greater cause for nervous exhaustion than the actual physical labor which she is called upon to perform. The second we cannot take away in a normal labor, but the first we can relieve, and its relief, I am sure, leaves the patient in a far better condition to enter upon her convalescence.

In the field of operative obstetrics, gas anesthesia finds a rather wide application. In that most common of all obstetrical operations, the primary repair of a perineal tear or of an episiotomy wound, gas is a most satisfactory agent when properly given, and in this provision, *"when properly given,"* we find the crux of the whole situation.

Surgical gas anesthesia is exceedingly safe and in a large percentage of operative cases, surgical and gynecological as well as obstetrical, a very satisfactory anesthesia when given by one who has been properly trained in its use. It is neither safe nor satisfactory when administered by one who has not been properly trained. This opinion has been expressed before by those who have had occasion to acquire some experience with it in operative work and after a considerable experience with gas anesthesia in abdominal, pelvic and vaginal work, I wish not only to agree with that opinion but to emphasize it.

I do not permit upon my service that any general anesthetic for operative work shall be given with gas for either a gynecological or obstetric patient except by the hospital anesthetist. Where it is necessary that the services of an interne be used, ether is always chosen.

A primary perineal repair is a surgical operation and requires that the patient should be relaxed and quiet upon the table. The patient who is but partly asleep and struggling interferes with asepsis and renders impossible a proper carrying out of even a simple surgical procedure. But as the child is now no longer in the uterus, rebreathing is no longer objectionable and the patient may be anesthetized, exactly as though she were to have any other operative procedure, and should it be necessary, a little ether may be added.

In the giving of surgical anesthesia in this as in all other operations, our aim should be not stubbornly to limit ourselves to one agent for the production of anesthesia, but to produce in the patient safely that degree of narcosis which is necessary for the proper carrying out of the procedure in hand. My repair operations, unless the injury be a quite extensive one, are usually done immediately after delivery and before the expulsion of the placenta. A gas-oxygen anesthetic for this purpose has not, in my experience, delayed the expulsion of the placenta except in those cases in which considerable ether is used, and these cases are but very few.

My attitude, however, toward the use of nitrous-oxid anesthesia in forceps operations is somewhat different. As I have mentioned above, I object to the use of rebreathing in an obstetric case prior to delivery on account of the fear of overcarbonization of the fetal blood. Without rebreathing it is difficult to secure that degree of relaxation which is necessary for the proper carrying out of even a low forceps operation. I have tried this faithfully many times and have had the anesthetic given by careful and competent anesthetists but with the exception of a few cases had poor results.

I have also tried repeatedly the use of gas oxygen without rebreathing with the addition of ether, but have almost invariably found that the amount of ether required was so great that there was but little advantage over a straight ether anesthetic. After faithfully trying out gas anesthetics for forceps operations over a considerable period of time I have now gone back to straight ether in these cases. I believe that the objections to ether in forceps operations are to be considered much less than the danger of disturbance of asepsis by the sometimes violent movements of the mother under an incomplete narcosis.

For the simple operation of induction of labor by the introduction of the hydrostatic bag, gas oxygen provides us with an ideal anesthetic. Complete relaxation is ordinarily not needed, hence extensive rebreathing is not necessary. However, should rebreathing to a moderate degree be required, inasmuch as delivery is still far off, it may be used, as any carbonization of fetal blood is done away with during the succeeding hours of labor, and, should one fear it greatly, the mother may be given a little oxygen at the termination of the anesthetic. These anesthetics are ordinarily short and gas permits the bag to be introduced without pain and allows the mother to wake up without nausea usually and without the deadening effect upon the uterine contractions which ether produces, when one is desirous that they should be immediately begun.

In case the introduction of more than one bag

in the same case is requisite, anesthesia may be repeated, and after dilatation is complete these cases receive analgesia during the second stage, exactly as I have described.

For evacuation of the uterus in cases of incomplete abortion or for the introduction of packing in cases of inevitable or therapeutic abortion, gas is equally desirable. In the hands of a competent anesthetist sufficient relaxation may almost invariably be obtained without the addition of ether and in these cases rebreathing may be used if needed. Cases of this character I have done with gas anesthesia for some years prior to the time we began to use it in obstetric work and in the past five years have used ether in cases of this sort probably not more than a half dozen times.

In Cesarian section I have had no experience with the use of gas, as I have always done these cases under ether. I have feared the effect of rebreathing upon the fetus and have not felt that sufficient relaxation could be gotten without rebreathing to make the procedure wholly safe. I feel also that the preliminary dose of morphin and scopolamin an hour prior to operation, which renders the giving of surgical anesthesia by gas oxygen much more easy, is objectionable upon obstetric grounds, inasmuch as delivery will occur in too short a time subsequent to the giving of these drugs. That morphin or scopolamin should not be given when delivery seems likely to occur in less than three hours is an obstetric rule, the validity of which is conceded even by the protagonists of the so-called *twilight sleep*. I intend, however, as soon as the opportunity presents in a nephritic case, doing this operation under local anesthesia with the possible addition of some gas, but with no preliminary administrations of narcotics.

CONCLUSIONS.

1. Gas furnishes an ideal method of relief of pain in normal labor, the safety of which, in competent hands, has been demonstrated by a large number of cases.

2. For all of the minor operative procedures in obstetrics and gynecology, such as primary perineal repairs, evacuation of the uterus, introduction of bag or gauze, gas supplies an efficient mode of narcosis which is free from most of the objections of ether.

3. For all operative procedures which are done before the delivery of the child, rebreathing should not be used.

4. In complete anesthesia in obstetric work as in complete anesthesia in surgery and gynecology, gas should always be administered by some one properly trained in its use and the fact that gas is highly safe in competent hands must not distract our attention from its dangers in untrained hands.

5. It is best to limit analgesia to a period of three hours.

1620 HINMAN AVENUE.

DISCUSSION.

DR. BEN MORGAN, Chicago, Ill.:—After a more limited experience of some 250 cases of gas-oxygen obstetrical analgesia, I agree with the efficiency of the technic Dr. Danforth has recommended. Aided by an expert anesthetist the obstetrician can be saved several useless hours of attendance, meanwhile remembering that delivery under gas-oxygen is more rapid than under other circumstances. The essential principle of success is anticipating the uterine contraction with the administration of the analgesic. The number of inhalations necessary to secure a proper depth and duration of analgesia depends on the volume of the patient inspiration and her breath-holding capacity. From three to six breaths of the gas-oxygen usually suffice. Rebreathing is not so dangerous as supposed, if properly handled and it may be necessary and desirable in controlling exaggerated pain, while occasionally it is necessary for conserving the supply of gases on hand. Of course it should never be used to the point of anoxemia. I have found concomitant etherization of value or ether-air a good substitute for the operative phases of obstetrics after gas-oxygen has supplied all requirements for the analgesic period of labor.

In Cesarean section the anesthesia is a major one and must be handled by an entirely competent anesthetist. It is not necessary to push gas-oxygen anesthesia to the point of relaxation as the abdomen of the pregnant woman is sufficient relaxed by admit of any manipulations necessitated by Cesarean section. The injection of pituitrin recommended by Dr. Webster I have also found efficacious not only obstetrically but also in stabilizing the circulation. It is not unusual in Cesarean section under gas-oxygen with pituitrin to put the mother back to bed without a variation in the pulse-rate.

DR. E. I. MCKESSON, Toledo, Ohio:—Patients can and should be trained to accept and manipulate analgesia. If permitted to experience the difference between normal labor pains and the obtunding effect of gas-oxygen, the mother's cooperation can usually be rapidly secured. It is necessary to have the breathing adapted to the requirements of the analgesia. Deep breathing and holding of the last inhalation accomplish a great deal in making analgesia satisfactory. There is no reason for cyanosis occurring even with some rebreathing. In some cases, of course, cyanosis will persist, irrespective of rebreathing or oxygenation, and in such cases cardiac incompetence is usually present. I have found gas-oxygen anesthesia entirely satisfactory for Cesarean sections, but profound anesthesia must not be used as it is harmful to both the mother and the child. The mother may be rendered cyanotic, the child anoxemic and the uterus may be paralyzed. Section should be done under light anesthesia, and immediately after incision of the abdomen pure oxygen should be given for two or three breaths. This assures enough oxygen to the child. When the child is delivered the anesthesia is resumed for whatever remains to be done. I have not found it necessary to use concomitant etherization with gas-oxygen for forceps deliveries. Viable children usually breathe promptly after the air-skin reflex despite the use of gas-oxygen analgesia or anesthesia. It is remarkable how some hysterical women will continue their complaints under analgesia, but will travel across continents to have the benefit of gas-oxygen in subsequent deliveries.

DR. ORVAL J. CUNNINGHAM, Kansas City, Mo.:—I have found the self-administration method of obstetric analgesia very satisfactory with gas-oxygen. Patients can anticipate the uterine contraction somewhat earlier than can the obstetrician or anesthetist and by beginning the inhalation of the gas-oxygen more promptly will accomplish

a better analgesia. The self-administration method can be continued until the patients want to pull down, at which time the anesthetist takes over the conduct of the analgesia. Gas-oxygen anesthesia is not only indicated for Cesarean section but especially in the presence of eclampsia. Pituitrin should be used with due caution. I have seen one instance of acute cardiac dilatation follow the administration of two doses of ½cc. twenty minutes apart.

DR. DANFORTH, (Closing):—I have nothing especial to add, except perhaps that obstetrical analgesia is something that can and should occupy the entire time of the person administering it. In the future, in view of the encouraging reports I have just heard, I shall use gas-oxygen anesthesia for Cesarean sections.

THE INFLUENCE OF CHLOROFORM ON THE STABILITY OF THE RED BLOOD CORPUSCLES.*

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Woolridge, by a chemical analysis of the composition of the red blood corpuscles, determined that about 30 per cent of the dry remnants of the stroma consists of so-called lypoid substances, chiefly lecithin and cholesterin. These findings were subsequently corroborated by Pascucci and others. Since both, lecithin and cholesterin, are to a very considerable extent soluble in chloroform, the chemical composition of the red blood corpuscles alone admits of the supposition that chloroform anesthesia is capable of influencing their stability in some way or other.

This supposition is corroborated by the fact that chloroform *in vitro* possesses the qualities of a strong hemolytic poison causing diffusion of the coloring substances (Bottcher, Hermann and others). This is likewise supported by the investigations of Pohl, who determined that the greatest part of chloroform in the blood circulation in chloroform anesthesia is retained by the red blood corpuscles; the latter, according to this author, being capable of retaining approximately four times more chloroform than plasma.

It is necessary, however, to take into consideration that during anesthesia the amount of chloroform in the blood is relatively small, being, according to Pohl, about 0.035 per cent of the entire amount of blood; and that chloroform is very quickly excreted from the organism. There are reasons to believe that within 30 to 50 minutes after anesthesia, a considerable part of the chloroform has left the body, chiefly through the lungs and somewhat less through the skin and kidneys (Lallemand, Duroy, Perrin, Fubini and Pohl).

The question as to the nature of the union between chloroform and the lipoids of the blood corpscles still remains open. The union is apparently not a stable one, as the absorbed chloroform easily separates when a layer of air is passed through the mass of blood. We must admit that in all probability we deal here with a simple process of absorption. It is apparent that the great importance of chloroform anesthesia in modern clinical surgery, together with the investigations of its influence upon the other organs and tissues, attracted the attention of investigators to its influence on the blood, as chloroform penetrates it first and by its aid is distributed to all other parts of the organism, particularly to the central nervous system.

We will limit ourselves to a very brief review of the investigations so far made for determining the influence of chloroform upon the stability of the red blood corpuscles. All these investigations have been of a laboratory character up to the present time. The method consisted chiefly of taking a specimen of blood from an animal and passing through it a mixture of chloroform vapor and various quantities of air. We have already mentioned that Bottcher and later Hermann have used this method for the purpose of determining the hemolytic properties of chloroform. It is conclusively proven that the diffusion of the coloring matter results from the injury to the lipoid components of the red corpuscles. Some of these proofs were given by Pariscot and Heully. *They proved that the time during which chloroform vapor is passed through the blood is a greater factor in the degree of hemolysis; the process of hemolysis being by far more extensive if even very small quanties of vapor are used for a longer time, than large quantities for a shorter period.* According to some authors the hemolytic properties of ether are very much weaker than those of chloroform.

All the investigations along this line show a certain onesidedness; in determining the influence of chloroform upon the stability of the red blood corpuscles, the standard of comparison was exclusively a hypotonic solution of sodium chlorid. But, according to our present knowledge, the osmotic stability can under no circumstances be considered as a full reflection of all those defensive powers which the red blood corpuscles exhibit when acted upon by various hemolytic agents. The methods or processes by which various hemotoxins injure the red blood corpuscles are far from being identical. This

*Researches from the Therapeutic Clinic of Prof. B. P. Obraschov of the St. Vladimir University, Kiev, Russia

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is due to the highly complex physico-chemical composition of the red blood corpuscles on one side, and to chemical and physical differences of various kinds of blood poisons on the other.

The hemolytic action of the anisotropic solution of sodium chlorid is based upon the destruction of the osmotic equilibrium within and without the red blood corpuscle, *i.e.*, the solution of the hemoglobin is due to a purely physical force. But in hemolysis caused by chloroform and other substances by destruction of the lipoid substances of the red blood corpuscle, the chemical and physical processes differ entirely from those observed in the sase of a simple destruction of osmotic equilibrium.

Evidently of the greatest interest is the answer to the question: How does chloroform affect those qualities of the red cells which are inherent to the corpuscles because of their lipoid substances? This interest is still greater because the group of hemotoxins, the mechanism of whose activities depends upon the action of the lipoid substances, is very large and variegated; to this group belong, besides chloroform, ether, acetone and fatty acids, also a long list of hemolytic poisons of vegetable origin, such as glucosides, saponins, sapotoxins, digitoxins, toxoalbumins, ricin, crotin and others. To this same group of lipoid hemotoxins may be added some bacterial toxins: strepto- and staphylolysin and tetanolysin.

The solution of this question can be reached by determining how the stability of the corpuscles is modified toward hemolysins by chloroform anesthesia. For this purpose we determined in our investigations the stability of the corpuscles towards hemolysins before and after anesthesia. Since we were investigating only chloroform anesthesia, we primarily directed our attention to chloroform. It was natural to presuppose that chloroform could more distinctly render the antichloroforming stability. As an additional investigation we also, in each case, determined the stability of the red blood corpuscles toward hypotonic solutions of sodium chlorid. It is plain that such a method of investigation affords an opportunity of observing also such results of the narcotic action, which, when determining only the antiosmotic stability, remained unnoticed. This particularly refers to the conditions of clinical chloroform anesthesia. In experimental chloroform anesthesia, either *in vivo* or *in vitro*, augmenting the action of chloroform, one can, of course, reach those degrees of injury to the lipoid substances of the red blood corpuscles, which show themselves by determining the osmotic resistance. But clinical anesthesia, for very evident reasons, is always limited as to the amount of chloroform. Thus, we figured to disclose by the aid of the above mentioned method, those modifications of the red blood corpuscles, which are caused by chloroform through the process of ordinary clinical chloroform anesthesia.

Blood for investigating purposes was taken by the aid of a syringe from one of the veins of the bend of the elbow. This was done at least twice: once during the day of operation one to three hours before the beginning of anesthesia and once 30 to 50 minutes after the termination of anesthesia. Since the technical details of determining the antiosmotic and antisaponic stability were described by us in one of our previous monographs, we will here limit ourselves to only a few explanatory remarks.

The antiosmotic stability of the red corpuscles was determined as follows: In a series of centrifugal test tubes (narrowed at the bottom), containing solutions of a gradually lowered strength of sodium chlorid, there was dropped fresh blood from the vein (two drops in each test tube). The difference of the strength of sodium chlorid solution in the adjacent test tubes was 0.03 per cent. The tubes were carefully shaken till the contents were of a uniform consistency. The measurement of antiosmotic stability was that strength of hypotonic solution in which after a definite period of time hemolysis took place. For the purpose of determining the antisaponin stability we used a series of similar test tubes of an increasing strength of a saponin solution (Saponinum albissimum—*Merck*) in 0.6 per cent. salt solution. The degree of solution of saponin was exactly established. For each cycle of observations upon the same patient, we used the same saponin solutions. Since both determinations were made the same day, we were fully insured that the glucoside solutions did not lose any of their hemolytic qualities. The antisaponin stability of the red blood corpuscles was measured by the degrees of strength of the corresponding saponin solution. Exactly the same principal is at the bottom of determining the antiacetone stability. The antichloroform stability we defined by the following method: We started with a saturated solution of chloroform in a 0.6 per cent. solution of sodium chlorid. In each subsequent test tube there were two more drops of chloroform. Because of the possible evaporation of chloroform as well as acetone, the solutions were made in an exactly constant and similar order previous to getting the blood from the vein. As a measurement of antichloroform stability of the red blood corpuscles we used the strength of chloroform of that

test tube in which there was complete hemolysis. The test tubes with the added blood were always kept for four hours at room temperature. For the purpose of pouring the solutions we used droppers, which insured the uniformity of the drops. The same kind of droppers were used for various solutions. The droppers, immediately after use, were thoroughly washed with water, alcohol and ether and dried by the aid of air. Likewise the test tubes were always used dry. Our observations were performed upon the material of the surgical clinic, both ambulatory and hospital.

In a series of 18 cases of major surgery, in patients between the ages of 13 to 67 years, lasting from 25 minutes to 2 hours and 5 minutes, it was noticed that in the majority of cases, chloroform, in a total dosage of from 8 to 52 gms., lowered, in a more or less constant degree the antichloroform stability of the red blood corpuscles, although a few cases showed no appreciable effect. It is difficult to form a definite relation between the amount of chloroform used during the operation and the degree of lowered antichloroform stability of the corpuscles. Evidently the minimum and maximum stability are to a certain extent independent, as in some cases one or the other stabilities was lowered, or when both decreased one was more affected than the other. Generally speaking a noticeable lowering of the maximum and minimum antichloroform stabilities followed the use of larger amounts of chloroform, or repetition of anesthesia for a secondary operation, associated with emaciation and poor contion of the patient. Individual peculiarities of the antichloroform stability may also have some relation to the amount and distribution of the lipoids of the corpuscles and the serum.

Chloroform anesthesia does not seem to have any noticeable influence on the antiosmosis stability of the red blood corpuscles. Out of 18 cases observed, the antiosmosis stability was not changed in 16. The antisaponin and antiacetone stabilities remain the same in most cases, although occasional lowering is noted both as to the maximum and minimum.

To determine the actual influence of chloroform anesthesia as the factor in changing stabilities, the stability of red blood corpuscles were also determined under local anesthesia. In four cases the method of determination was that already explained. In other cases the stability of the red cells, previously washed in a 0.6 per cent. solution of sodium chlorid, 3 times within one hour and centrifuged and then made into a 33 per cent. solution (by weight) in 0.6 solution of sodium chlorid, 6 drops to each test tube, was thus determined.

In none of the cases operated on under local anesthesia was any lowering of the stabilities noticeable, either for the whole blood or the washed cells. These investigations corroborate the view that chloroform anesthesia itself, and not the operative procedure, directly effects the stabilities of the red blood corpuscles.

In the researches as conducted a certain amount of chloroform remained in the blood system 40 to 50 minutes after operation when the tests were made. The question, therefore, arose: "Whether this insignificant addition to the strength of the chloroform solution in the test tubes accounted for the results obtained?" To solve this problem the red blood corpuscles were washed in a 0.5 per cent. solution of sodium chlorid before as well as after operation. The washing was done by centrifuge for a period of one hour and fresh saline solution was added four times. A 33 per cent. solution of washed cells was made with a 0.6 per cent. saline solution and 6 drops used for each test tube. It was found that the antichloroform stability of the corpuscles was lowered even when washed, proving conclusively that the lipoid substances of the corpuscles are actually injured by the chloroform and that the insignificant amount remaining in the blood was not the determining factor.

The next question to be solved was: "How long does the lowered stability of the corpuscles last and to what extent can the stability be restored?" Our researches indicate that the antichloroform, antiacetone and antiosmosis stabilities of the red blood corpuscles remain unchanged in the same case for a period of 24 hours, provided, of course, that during this period nothing further occurred that would tend to lower these stabilities. This observation also holds good for secondary operations.

The first stability to be restored is the minimum. This occurs in from 16 to 18 hours; in 24 to 26 hours the maximum stability is also restored.

In concluding the results of our work we will cite observations on the influence of chloroform anesthesia on the stability of red blood corpuscles *in vitro*.

Four cc. of freshly obtained blood was poured in each of two test tubes (A and B). The corpuscles were washed for an hour by the aid of an electric centrifuge and salt solution was added three times. After the third addition of salt solution, it was decanted and into the test tube A 5 to 6 cc. of the same salt solution was added and into the test tube B was added a similar amount of the same salt solution containing a saturated solution of chloroform.

We discovered that such addition of chloroform

did not cause hemolysis. In order to find out whether the red blood corpuscles actually remain unchanged as to the antichloroform stability or not, the following experiment was performed:

Both test tubes with their contents (A, salt solution and B, chloroform solution) were corked with cotton and put in the incubator for one hour at a temperature of 38 degrees Centigrade. Then the contents of the test tubes were centrifuged, decanted and the corpuscles washed for one hour with salt solution added to each test tube three times. From the washed red corpuscles of each tube, we made 33 per cent. solutions (by weight) in a 6 per cent. solution of sodium chlorid and added 6 drops to each tube (these drops were taken from test tubes A and B).

The results of these investigations of the chloroform action upon the corpuscles approximate very much the results obtained under clinical circumstances.

CONCLUSIONS

We briefly repeat the results of our investigations: Chloroform anesthesia lowers the stability of the red blood corpuscles; the antisaponin and antiacetone stabilities are not so often affected, and, finally, the antiosmosis stability after chloroform anesthesia is rarely comparatively lowered.

Also, our investigations corroborate the specificity of the different methods of hemolysis. Chloroform, injuring the lipoid substances of the red elements of the blood, must, of course, show its destructive action much more so when these substances of the blood had already been acted upon by previous narcosis. But the lipoids are acted upon, although in a different manner, by other substances, such as saponin and acetone; the first enters with cholesterin and lecithin into a permanent chemical union; and acetone, in solutions that cause hemolysis, besides its action upon the lipoids causes coagulation of the albuminous bodies (*Koppe*).

At any rate, the process of chloroform anesthesia, causing a more or less noticeable destruction of the lipoid substances of the red blood corpuscles, may cause a lowered stability also with regard to these hemotoxins. The mechanism of the hemolytic action of hypotonic salt solutions, however, is not connected with the state of the lipoid substances of the corpuscles; this is why injury to the lipoids caused by chloroform anesthesia seldom lowers the antiosmosis stability.

In conclusion, we wish to offer our thanks to Professor H. M. Volkovitch for his kind permission to use the material from his clinic, and also to all those connected with the surgical clinic for their friendly co-operation during the performance of these experiments.

410 ARMORY AVENUE.

BLOOD-PRESSURE AS A GUIDE DURING MAJOR OPERATIONS.*

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It is a well-recognized surgical principle that whatever measures may avail to safeguard the patient before, during, and after operation, should be taken. In a previous communication we have pointed out the necessity for most careful study of our patients' vitality and physical idosyncrasies before bringing them to the table, as well as the need of painstaking watchfulness throughout their convalescence. But while these measures are most highly desirable, and to neglect them is inexcusable, we should go still further, especially in capital surgical procedures, and keep ourselves informed throughout the operation as to the exact condition of the patient. Such information it is perfectly easy to obtain through frequent readings of the blood-pressure. These may be taken by the anesthetist without in any way interfering with his other work, and the information which he from time to time imparts is of great value to the operator. When all is going well, it is a distinct comfort to know it, and, on the contrary, if the patient's condition begins to decline, the operator is forewarned of impending disaster, and may take proper steps to combat it.

With a view to determining the value of blood-pressure as an index during operations, we have studied a series of 50 cases, deliberately selecting operations of the distinctly major type, with enough simple ones to act as controls. The extensive pelvic dissections incidental to the radical Wertheim operation for cancer of the uterus, and the trying operations in and about the mouth and neck for the same disease as performed by Dr. Farrar Cobb at the Massachusetts General Hospital, offered unusual and extreme opportunity for our study. Such operations, of course, place a tremendous tax on a patient's vital forces, and whatever changes may take place in major work are most likely to appear in this class of cases.

Plan of Study:—For comparison with each patient's pressure during operation, we noted his pressure at the time of entrance to the hospital, taken as a matter of routine in the physical examination. With this as a starting point, the pro-

*Read during the Sixth Annual Meeting of the American Association of Anesthetists, Auditorium Hotel, Chicago, Ill., June 10-11, 1918.

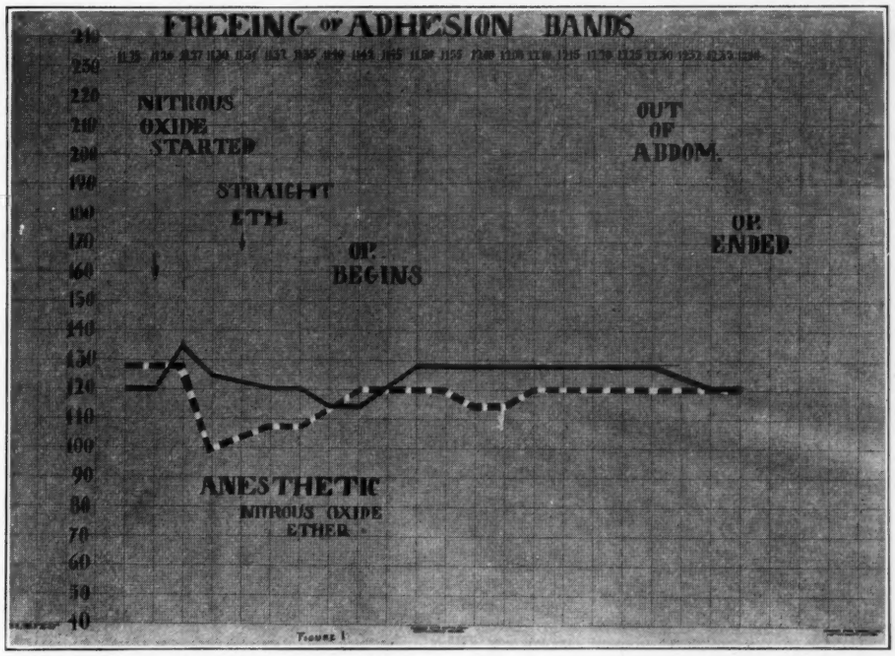

Chart I—Note initial rise of blood-pressure almost synchronous with beginning of nitrous oxid, which soon fell again to the *individual level*, remaining there throughout the operation. This chart is characteristic of the controls.

cedure was as follows: The systolic pressure and the pulse rate were noted when the patient reached the etherizing room and before anesthesia was started, again at the time it was started, and at least once every five minutes throughout the operation. In many instances, or whenever there was taking place an obvious change in the readings, we recorded that change as often as once in two or three minutes. In addition, there was noted the time the operation was started, any change in the patient's position on the table, any specific steps, such as ligation of important vessels, anything likely to produce sudden reaction, or any event of special interest.

A Tycos sphygmomanometer was employed, and in the abdominal operations the patient's arm was carried above the head; in operations about the head and neck, where the arm lay at the side, the length of the tubing running from the cuff was increased by using glass connecting tubes between this tubing and other pieces of similar diameter about a foot long. In this way it was easy to get

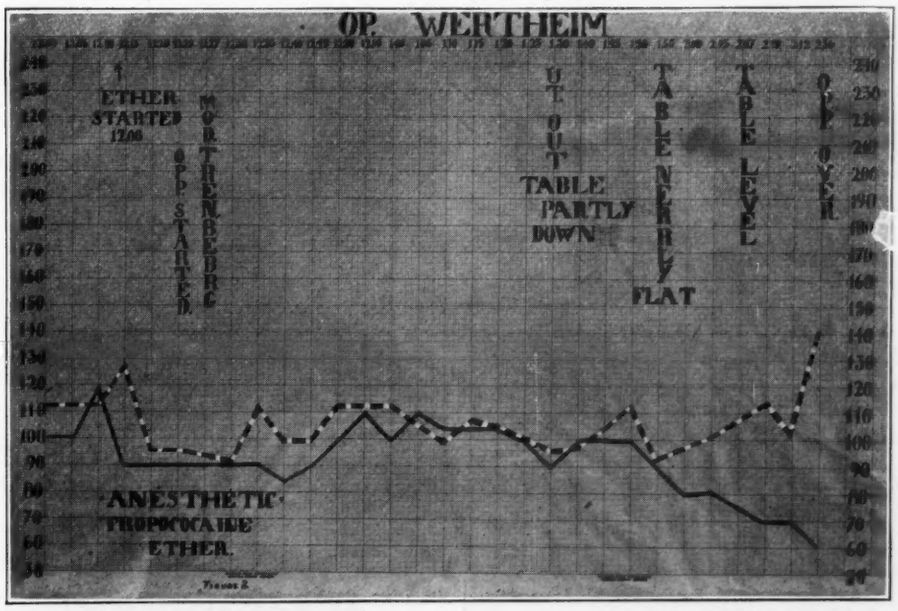

Chart II.—Illustrating the drop in pressure to a point below the *individual level* after the initial anesthetic rise. This phenomenon, followed by the rebound to the patient's level, is nearly constant.

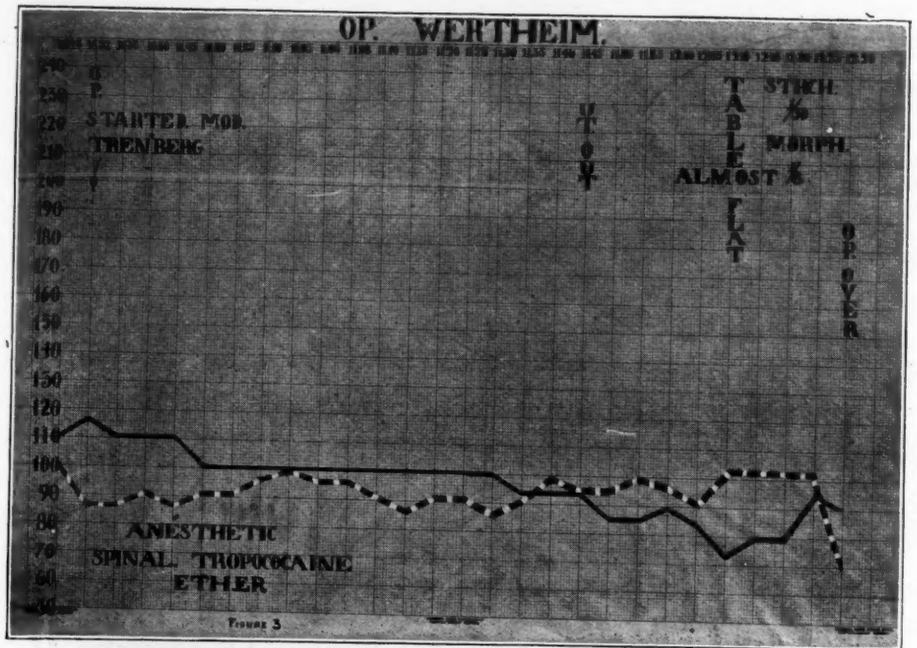

Chart III.—In this case, at 11:30 a. m., an hour after the operation had been started, there began a gradual fall of pressure, indicative of failure. The alteration was unaccompanied by appreciable change in the pulse rate. The upward rise at 12:10 p. m. was in all probability due to the fact that no more traumatizing work was going on in the pelvis.

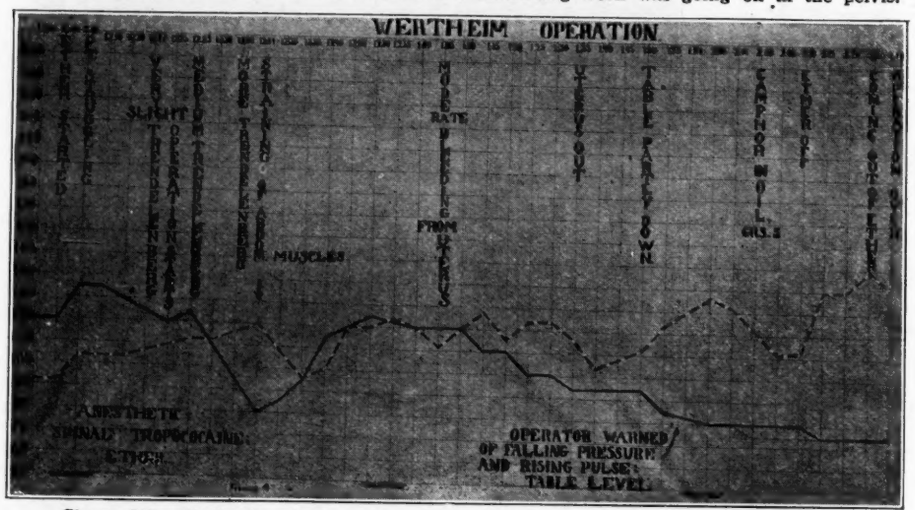

Chart IV.—Moderate shock, with gradual fall in pressure and rise in pulse rate. Observe that the pressure fall began from a quarter to half an hour before the pulse rate appreciably increased. The sudden drop at 12:25 p. m. was very likely due to the increased Trendelenburg position and to the **musclar** straining.

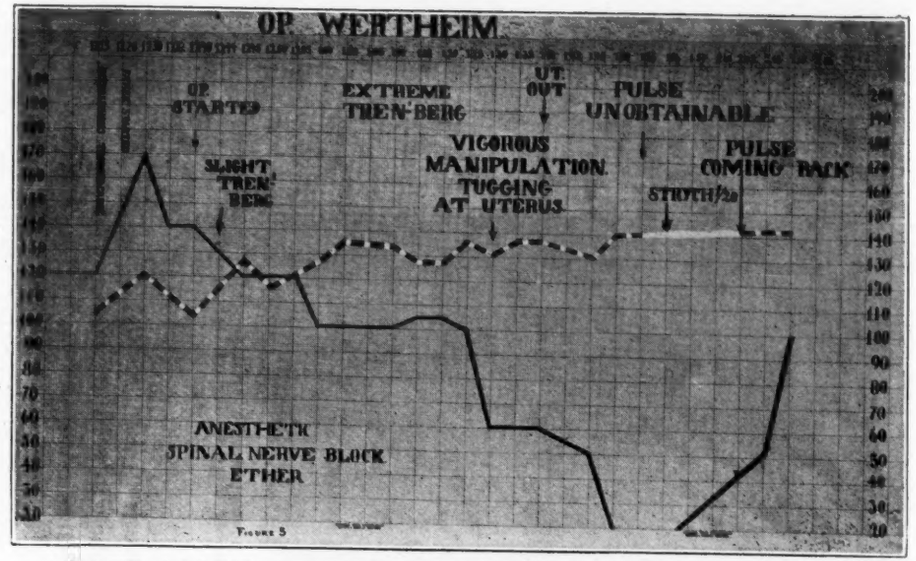

Chart V.—Typical chart of shock, in which the fall in pressure and rise in rate were practically simultaneous. The sudden drop at 1:30 p. m. is illustrative of what manipulation of the pelvic and abdominal organs may produce in pressure changes.

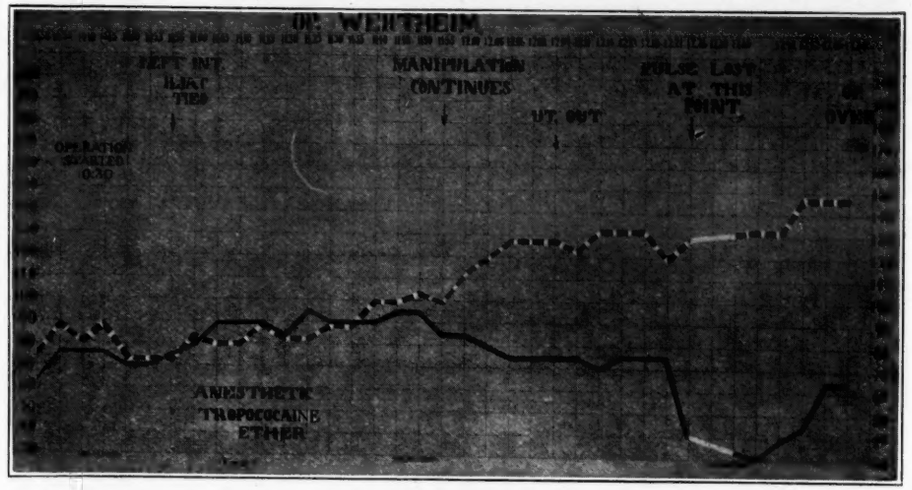

Chart VI.—Characteristic shock chart. An initial fall, as illustrated here, following the intraspinal injection of tropacocaine, was not uncommon. During the first hour the pressure rose from a low point at the start to a higher level. From 11:30 to 11:50 a. m. the operator was freeing the parametrium from pelvic walls, the procedure requiring a good deal of manipulation. This undoubtedly was what induced the shock. This patient responded very quickly to stimulation after being put to bed.

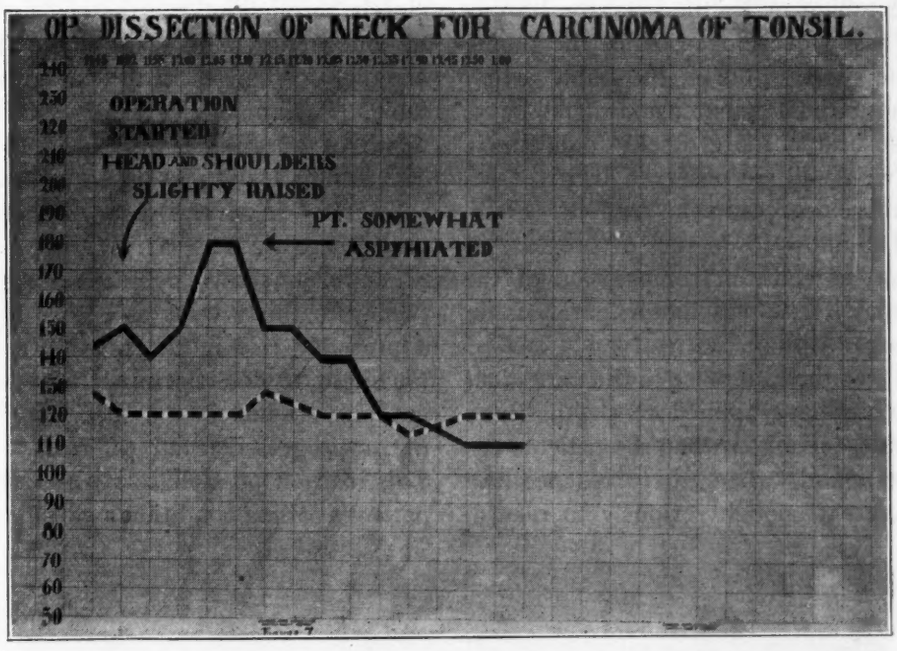
OP. DISSECTION OF NECK FOR CARCINOMA OF TONSIL.
OPERATION STARTED
HEAD AND SHOULDERS SLIGHTY RAISED
PT. SOMEWHAT ASPYHIATED

Chart VII.—At 12:00 m. the first upward rise was noted. During the next five minutes it went from 150 to 180. At this point the interference with respiration was eliminated and the pressure immediately dropped. The continued fall was probably a forerunner of shock.

the pressure at all times without interfering with the operator.

In making these observations there are several opportunities for error, which must be guarded against. First, it is essential that the measurement be taken at the same level as the heart, for if made at a point lower than the heart we obtain not only the blood-pressure, but the weight of the column of blood representing the difference between the level of the heart and the level of the observation, and, bearing in mind that a column of blood 10 cm. high gives a reading of 8.5 mm., the necessity for care is obvious; and conversely, if the point of reading be above the heart, a corresponding error in the negative direction occurs, so that we do not get the full pressure value. Second, the cuff sometimes slips on the arm, even to below the elbow. It must be firmly adjusted; otherwise the reading may be from 20 to 30 mm. too high. Third, the air may be partially or completely shut off, either

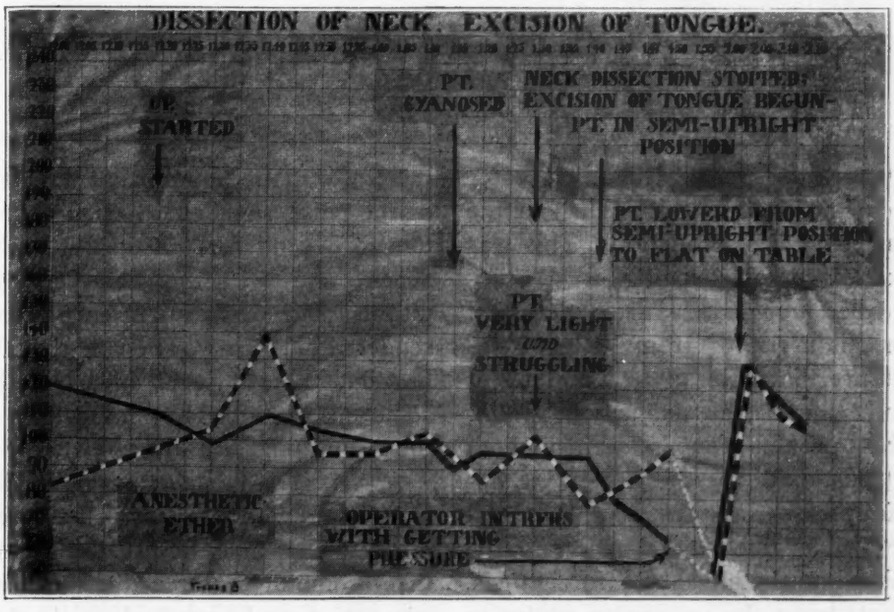
DISSECTION OF NECK. EXCISION OF TONGUE.
OP. STARTED
PT. CYANOSED
NECK DISSECTION STOPPED; EXCISION OF TONGUE BEGUN—PT. IN SEMI-UPRIGHT POSITION
PT. LOWERD FROM SEMI-UPRIGHT POSITION TO FLAT ON TABLE
PT. VERY LIGHT AND STRUGGLING
ANESTHETIC ETHER
OPERATOR INTERFERS WITH GETTING PRESSURE

Chart VIII.—Phenomenon of cerebral anemia. Note the instant drop in pressure at 1:40 p. m. when patient was put in semiupright position; also the continued and rapid fall in both pressure and pulse until table was again in a horizontal plane. Then observe the instant rebound to point above the *individual level* and immediate subsidence toward subanesthetic line.

by a kink in the tubing or by the operator leaning against it, both easily overlooked, since the tubing is covered by the sheet. Fourth, the radial artery should not be on a stretch by extension of the hand, as thus the pulse beat is more quickly obliterated. Flexion of the wrist, as we observed it, gives between 5 and 10 more degrees in the reading. Fifth, it is always well to allow 10 degrees of pressure as the limit of error, as constant compression of the patient's pulse may cause vasomotor paralysis in the recorder's finger tips.

In no instance was the difference in the *individual levels*—the term we have applied to the patient's normal waking rate—as taken when the patients entered the hospital and when they reached the etherizing room, great enough seriously to regard.

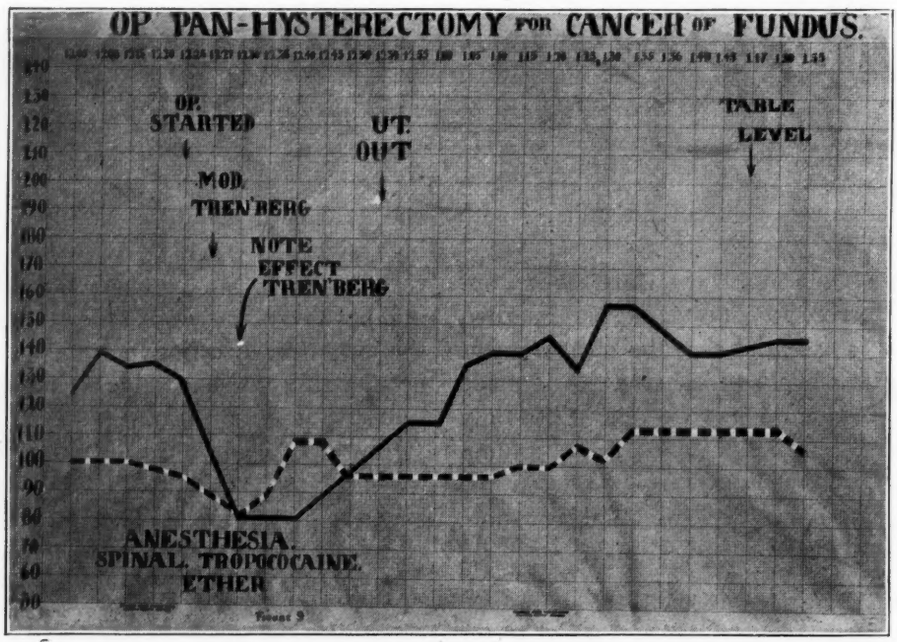

Chart IX.—Effect of Trendelenburg position (see also Charts II, IV, V, X. Chart II illustrates that occasionally there may be no change whatever). In all these cases of Trendelenburg position it is not unlikely that the fall may have been due to manipulation of the pelvic viscera, or possibly to the gravitation of the tropacocain to the higher nerve centers.

Their readings were, as a rule, slightly greater when they came to the operating floor than at the time of the initial physical examination. This was due, no doubt, to fear or excitement.

As a general rule, immediately after the start of anesthesia there is a rise of from 10 to 30 degrees in the pressure, but after a few minutes it again falls to somewhere near the patient's *individual level.* This phenomenon is seen in both ether and in nitrous oxid anesthesia, and it appeared also in four cases anesthetized by rectal anesthesia. The rise is due, undoubtedly, to the sudden introduction into the blood of a foreign gas, which instantly acts upon the vasomotor center in the medulla, raising the pressure. The *individual level,* after being reached, is maintained rather closely throughout anesthesia, barring changes due to oncoming shock, asphyxia, sudden cerebral anemia, or changes in the patient's position on the table. Certain other factors, such as struggling, depth of anesthesia, and manipulation of organs, also influence the pressure, but to a less degree.

Shock:—In several cases of shock of varying degree, there was, as a rule, a gradual fall in the pressure, as shown by the readings, starting from twenty to thirty minutes before there appeared an appreciable rise in the pulse rate. This fall was too slight to detect without a recording apparatus, but was gradual in the succeeding readings, showing a progressive fall of from 5 to 10 degrees. This made it possible to notify the operator of the patient's failing condition a considerable time before there was noticeable change in the quality or rate of the pulse, signs on which it is ordinarily the custom to depend for warning of imminent failure or shock; and by acting early in these cases, conditions which easily might have become serious were rendered harmless. The rule that the pressure falls first does not, however, invariably hold true, for in some instances the beginning drop in pressure and the rise in pulse rate were virtually simultaneous.

Asphyxia:—Janeway has pointed out that in first-stage asphyxia, during which the respiratory center is stimulated and the breathing is rapid and deep, the vasomotor center in the medulla is also thrown into action, and a marked rise in the blood-pressure occurs. This is also seen in slighter grades of deficient oxygenation of the blood. Janeway applies

this observation more especially to the study of cardiac and lung conditions and to laryngeal diphtheria.

This phenomenon occurred in two cases of the series, both in operations about the face. In each instance it was possible to warn the operator, even before there had taken place the usual darkening of the blood, that the patient was getting an insufficient supply of air. As the difficulty in these cases is usually due to the operative procedures, rather than to the anesthetic, the warning to the surgeon is of real value. Chart VII vividly represents the pressure change which comes with interference in breathing.

Cerebral Anemia:—In cerebral anemia the pressure phenomenon is exactly the reverse of what is seen in asphyxia. In each of the three operations in which it was observed,—all of them for cancer about the mouth,—the patients were, at the time of the occurrence, in the reversed Trendelenburg position. The fall in pressure was invariably almost instant, very alarming, and accompanied by marked slowing of the pulse. Immediately on change of position to the level, or slight Trendelenburg, the pulse and pressure righted themselves with a bound, going at first to an excess of the rate they had maintained up to this time, then quickly subsiding to the normal subanesthetic point for the individual.

Trendelenburg Position:—It has been said that the effect of the Trendelenburg position is unfavorable to patients, and, with a view definitely to determine whether this was so, we carefully observed the result of placing individuals in this unnatural posture. In nearly every instance there was an almost immediate fall in pressure, to a greater or less degree, though, as a rule, the downward curve was not an alarming one, and the pressure soon returned to the *individual level*. Nor did keeping patients in this position over considerable lengths of time apparently produce untoward results.

Conclusions.

The blood-pressure index is a valuable guide in major surgical work. It is of special value in operations likely to be of long duration, in which the element of shock is apt to appear; also in operations upon delicate women, weak men, or obviously poor risks. In great operations about the head or neck it is of very definite worth, frequently giving warning, as nothing else could, of approaching asphyxia or cerebral anemia. In the class of cases studied it adds to the operator's sense of security and to the patient's safety. We do not, however, advocate it as a routine measure.

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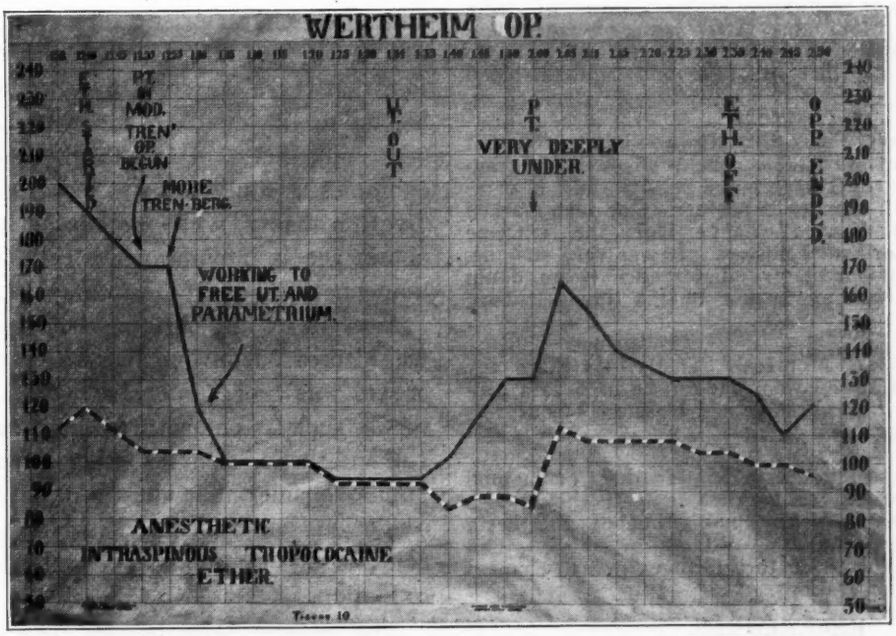

Chart X.—Illustrates very graphically the combined effect of Trendelenburg position and manipulation of the pelvic organs. The latter was undoubtedly the principal factor in this instance, for the drop came almost immediately after the operator began his work in the pelvis. Observe the rise which appeared as soon as the uterus was removed.

Discussion.

Dr. E. I. McKesson, Toledo, Ohio:—Blood pressure readings should be taken as a routine during all major operations, as they give the most reliable information of the patient's condition and the myocardial reserve. The disastolic as well as the systolic pressure must be taken in order to determine the actual heart load. While blood pressure charts have been a hobby of mine and I have recorded thousands, several of Dr. Giddings' are new to me and show certain effects of combined ether and tropococain anesthesia which have not come under my observation. A pulse rate of from 100 to 112 with a systolic

pressure of 100 is not typical of shock. Apparently even under deep etherizations the blood pressures do not fall until the tropococain has been added. As Dr. Giddings suggests this may be due to the tropococain reaching the higher centers or its more immediate effect on the vasomotor system through the spinal ganglia and circulatory system. In these particular charts then collapse and not typical shock is indicated. Pressures if taken at the proper moment, will show a fall before there is a rise in the pulse rate. If the heart is compensating the pressure must also rise; otherwise collapse must result. The rise of pressure during the induction of anesthesia is temporary and probably due to psychic causes and comes from the increased pulse rate. By taking both pressures it is possible to determine if circulatory failure is peripheral or cardiac. If the fall in pressures is disproportionate the trouble is peripheral, otherwise cardiac. By using auscultation the blood pressures can be taken very conveniently every five minutes during the operation or more frequently if necessary. A rise in blood pressure is not sustained above the patient's normal. The extreme Trendelenburg posture should never be used. Beyond 10 to 15 degrees it may lower pressures to the shock point. This should never be allowed to occur as recovery is never complete. Struggling and breath holding or respiratory embarrassment will raise pressures from 30 to 40 mm. After years of experiment and clinical observation I am convinced that there is no anesthetic now in use that will raise and maintain blood pressure.

DR. R. M. WATERS, Sioux City, Iowa:—I have found it difficult to draw any profitable conclusions without readings of both pressures. I have noted peculiar falls in pressure associated with changes in posture. One such marked instance occurred after a change from the extreme lithotomy to the horizontal posture. It was very striking. The mechanism of circulatory disturbance is no doubt similar to that occurring in use of the Trendelenburg posture.

DR. W. B. HOWELL, Montreal, Canada:—Is there any drug or method of stimulation that can be used as a routine and depended on to restore and maintain blood pressure and counteract shock?

DR. E. I. MCKESSON, (Closing):—No drug or method is uniformly successful or dependable. It should also be remembered that patients coming out of anesthesia may faint, thereby simulating collapse or shock. This fact may account for circulatory changes due to changes in posture during operations.

REFERENCES.

1. Giddings: Post-Operative Treatment. Boston Med. and Surg Jour., June 8, 1916.
2. Janeway: The Clinical Study of Blood-Pressure, pp. 37,38.
3. Janeway: The Clinical Study of Blood-Pressure, p. 59.

IT IS RATHER A DIFFICULT MATTER FOR THE SECRETARY OF AN ASSOCIATION OF ANESTHETISTS TO CONTINUALLY DEVELOP INTERESTING PROGRAMS UNLESS THOSE ANESTHETISTS WHO ARE ACCOMPLISHING SOMETHING OUT OF THE ORDINARY GET IN TOUCH WITH HIM AND INFORM HIM ABOUT THEIR RESEARCHES AND CLINICAL RESULTS. IF YOU HAVE A CONTRIBUTION TO PRESENT THAT ATTACKS SOME ANESTHETIC PROBLEM FROM A NEW ANGLE DO NOT HESITATE TO WRITE THE EDITOR OF THE SUPPLEMENT SO THAT YOU MAY BE GIVEN A PLACE ON ONE OF THE SEVERAL PROGRAMS NOW BEING ARRANGED FOR THE 1919 MEETINGS. MAKE YOUR PAPERS BRIEF AND TO THE POINT. IF YOU HAVE ANY SUGGESTION FOR MAKING THE MEETINGS MORE INTERESTING SEND IT IN.

HOW ANESTHETICS PRODUCE ANESTHESIA.*

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URBANA, ILLINOIS.

Many theories have been advanced in attempts to explain the mode of action of anesthetics in producing anesthesia. Bibra and Harles (1847) held that anesthesia was due to the dissolving and direct removal of the fat-like substances or lipoids from the brain cells by the anesthetic. The rapid recovery alone upon cessation of anesthetization is regarded as sufficient evidence to render this theory untenable. According to the theory of Meyer[1] and Overton[2] the narcotics of the methane series produce their characteristic effect by going into solution in the lipoids of the nervous system. The fact that there are so many anesthetics that do not belong to the methane series and are not fat solvents (nitrous oxid and magnesium sulphate being examples), would seem to indicate that the Meyer-Overton theory, while explaining how the narcotics obtain access into the nerve cells, does not explain how anesthesia is produced.

Paul Bert[3] and Arloing[4] showed that oxidation was decreased during anesthesia and that this decrease was more extensive with a powerful anesthetic, such as chloroform than with a less powerful anesthetic, such as ether. Verworn[5] and his pupils consider that anesthesia is due to decreased oxidation, while Crile[6] claims that it is due to the acidosis arising from the diminished or defective oxidation.

The present investigation was begun in an attempt to determine how anesthetics decrease oxidation. We[7] had already found that whatever increased oxidation in the body produced a corresponding increase in catalase, an enzyme possessing the property of liberating oxygen from hydrogen peroxid, by stimuating the liver to an increased output of this enzyme and that whatever decreased oxidation produced a corresponding decrease in catalase by decreasing the output from the liver, and by the direct destruction of the enzyme. Hence, the conclusion was drawn, that catalase is the enzyme principally responsible for oxidation in the body. Stated more specifically, the present investigation was begun to determine if anesthetics produce a decrease in the catalase of the blood and hence of the tissues parallel with the decrease pro-

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duced in oxidation and if this decrease is proportional to the depth of the anesthesia.

The animals used in the experiments were cats. The catalase of the blood was determined by adding 0.5 cc. of blood taken from the external jugular vein, to 250 cc. of diluted hydrogen peroxid in a bottle at approximately 22° C., and as the oxygen gas was liberated it was conducted to an inverted, graduated vessel, previously filled with water. After the oxygen gas thus collected in ten minutes had been reduced to standard atmospheric pressure, the resulting volume was taken as a measure of the amount of catalase in the 0.5 cc. of blood.

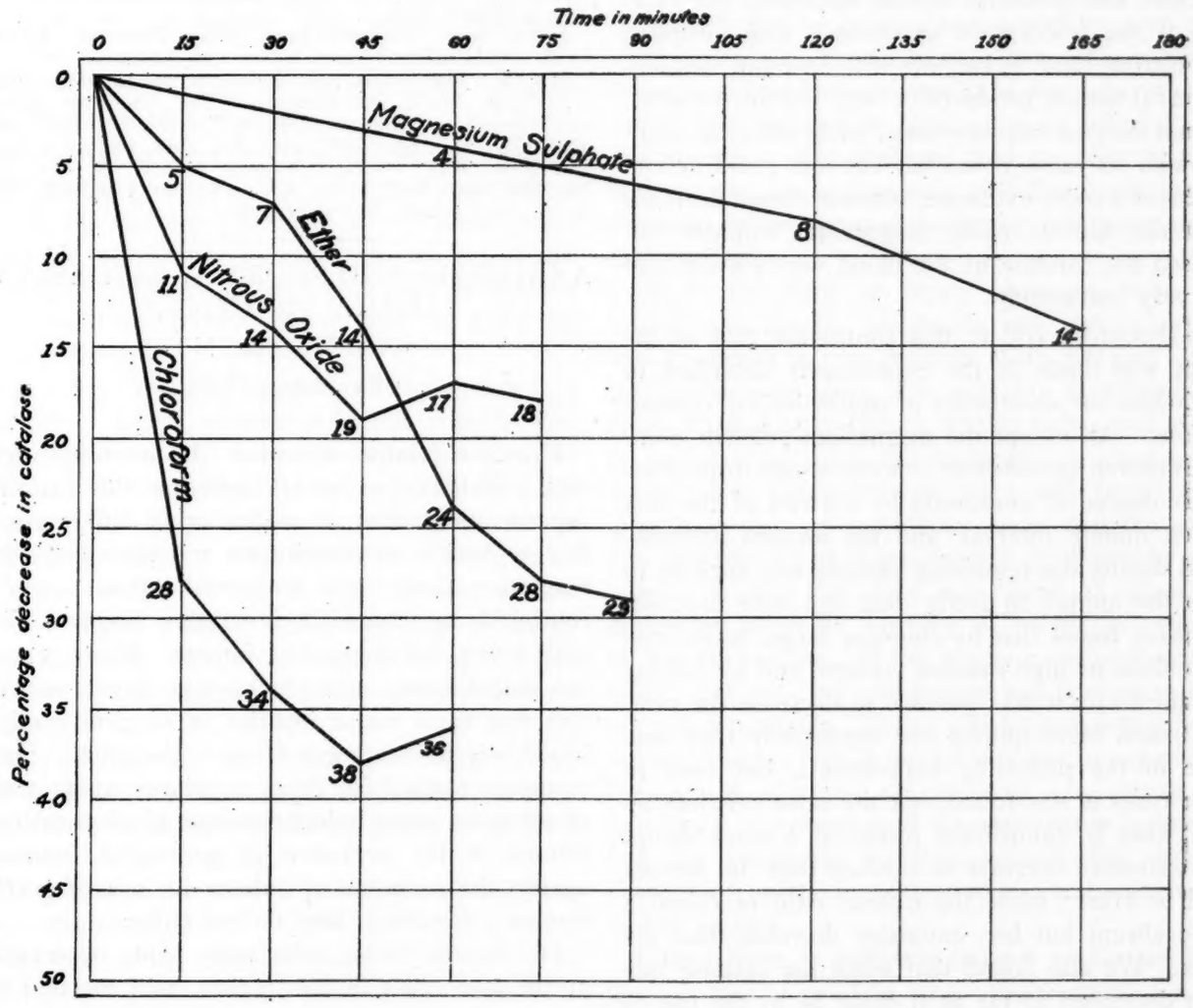

Figure 1.

The material was shaken in a shaking machine at a fixed rate of one hundred eighty double strokes per minute during the determinations. The results of the determinations are given in Figure 1. The figures (0-180) along the abscissa indicate time in minutes; the figures (0-40) along the ordinate indicate percentage decrease in catalase.

The anesthetics used were ether, chloroform, nitrous oxid and magnesium sulphate. These widely different kinds of narcotics were chosen intentionally. The chloroform and ether were administered by bubbling air through these anesthetics in a bottle which was connected by a rubber tube to a cone adjusted to the snout of the animal; the magnesium sulphate anesthesia was produced by the subcutaneous injection of 7.5 cc. of a 20 per cent. magnesium sulphate solution per kilogram of body weight, and the nitrous oxid anesthesia by administering a mixture of nitrous oxid in the proportion of 1 to 5, or 80 per cent. nitrous oxid and 20 per cent. oxygen. The curves in Figure 1, marked chloroform, nitrous oxid, ether, and magnesium sulphate were constructed from data obtained from cats during anesthesia produced by these different anesthetics. It will be seen that chloroform decreased the catalase of the blood 28 per cent. during the first fifteen minutes of anesthesia, 34, 38 and 36 per cent. during the succeeding fifteen minute intervals. Nitrous oxid decreased the catalase of the blood 11 per cent. during the first fifteen minute interval, 14, 19, 17 and

18 per cent. during the succeeding fifteen minute intervals. By examining the curves marked ether and magnesium sulphate, the rate and extent to which these anesthetics decreased catalase may be seen.

If narcosis is due to decreased oxidation and if this decreased oxidation in turn is due to a decrease in catalase then the destructive effect of an anesthetic on catalase should be an index to the character of anesthesia produced by the anesthetic in question. By comparing the rate and extent of decrease produced by the different anesthetics used it may be seen that chloroform, in keeping with its rapid and powerful action, decreased the catalase of the blood most extensively and abruptly; that nitrous oxid, in keeping with its rapid, but less powerful action, produced a very abrupt decrease, but not such an extensive one; while ether, in keeping with its more powerful, but less rapid action, produced a more extensive, but less abrupt decrease than did nitrous oxid; magnesium sulphate decreased the catalase of the blood very slowly, and not very extensively.

It should be said in this connection that no attempt was made in the experiments described to administer the anesthetics in equimolecular concentrations. All except the magnesium sulphate were administered in sufficient concentrations to produce a fair degree of anesthesia by the end of the first fifteen minute interval, and the amount administered during the remaining periods was such as to keep the animal in fairly deep but safe narcosis. We have found that by choosing large, active cats with blood of high catalase content, and by forcing the anesthetic it was possible to decrease the catalase much more quicky and extensively than was done in the preceding experiments, but even in these cases it was found that the same relationship held; that is, chloroform produced a more abrupt and extensive decrease in catalase than did nitrous oxid or ether; while the nitrous oxid produced a more abrupt but less extensive decrease than did ether. We also found that when the catalase had been decreased as far as it could be by the use of nitrous oxid, it could be decreased considerably more by changing to chloroform. It may be that the greater tendency toward acidosis in chloroform narcosis is due to this greater destruction of catalase with resulting decrease in oxidation, and to the greater injury of the liver, the organ in which catalase is formed.

SUMMARY.

1. Narcotics of widely different constitution, such as chloroform, ether, nitrous oxid and magnesium sulphate, decrease the catalase of the blood, parallel with the increase in the depth of narcosis.

2. A very powerful anesthetic, such as chloroform, decreases the catalase more quickly and extensively than does a less powerful anesthetic, such as ether. Slowly acting anesthetics, such as magnesium sulphate, decrease, accordingly, the catalase of the blood more slowly than a quickly acting anesthetic such as nitrous oxid.

3. As a result of the experiments reported in this paper, and of work done previously on the anesthetics in this laboratory, the theory is advanced that narcosis is primarily due to the decrease in catalase produced by the decreased output from the liver, and by the destruction of catalase by the narcotic, with resulting decrease in oxidation and increase in acidosis.

BIBLIOGRAPHY.

1. Meyer: Arch. f. exper. Path. u. Pharm., 1899.
2. Overton: Studien über die Narkose, Jena, 1901.
3. Bert: Dastre, Les Anaesthesiques, Paris, 1890.
4. Arloing: Ibid.
5. Verworn: Narkose, Jena, 1912; Narcosis, Harvey Lect., 1912, 152.
6. Crile: The Origin and Nature of the Emotions, 1915.
7. Burge, Neill, and Kennedy: The American Journal of Physiology, 1916, xli, 153; 1917, xliii, 58; 1917, xliii, 433; 1917, xliii, 545; 1917, xliv, 290, 1918, xlvii, 13; Arch. Int. Med., 1917, xx, 892; Science, 1917 N. S., Vol. xlvi, No. 1192, 440; 1917, N. S., Vol. xlvi, No. 1199, 618; 1917, N. S., Vol. xlviii, No. 1239, 327.

ANALGESIA AND SHORT ANESTHESIA IN DAILY PRACTICE.*

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EVANSTON, ILLS.

Pain is a relative sensation. Its intensity varies with individuals, as we all know, but this variation depends more than we realize upon differences in things physical as constitution and inheritance and temporary state; or as to mental attitude, such as continued or recurrent irritations, worries; and with fever, and degrees of fatigue. Many persons are called brave and plucky who know not the suffering from major injuries or surgical manipulation which others get from a pin prick. Some races are praised for great endurance under stress of all types when indeed, because of physical conditions or the evolution of protective functions against the sensation of pain or its lack of perfection as a sensation, they do not suffer.

Dr. George Crile,[1] who early made observation at the war front in this regard, told me that the exhausted man had little sensation of pain remaining. The added pain of operation is trivial compared with the previous suffering.

It is probable that the sensation of pain is a function becoming or remaining active according to its protective value and when it fails of manifestations it is either disordered, as for instance in pituitary disease, or of no value because of the enormity of

*Read during the Sixth Annual Meeting of the American Association of Anesthetists, Auditorium Hotel, Chicago, Ill., June 10-11. 1918.

the injury, as by instantaneous severing of a limb; or its needlessness as in brain or bone injury or in exhaustion states.

Pain is rendered keener, by repetition,—a cumulative stimulus, as in the field of the special senses,—and its experience in and after childhood, makes for hyperesthesia throughout life.

We are a sensitive nation comparatively. There are exceptions due to racial and individual variations, but in general in daily practice we encounter hypersensitive patients.

And because of the evils of early inflicted pain and the cumulative stimulus of its repetition, it should be our business to save the suffering daily experience by our patient. The painful examination, the opening of furuncles, paracentesis, removal of foreign bodies, setting fractures, reducing dislocations, introduction of sutures and their removal, first dressings of open wounds and burns, skin-grafting, passing of probes, minor operations of types too numerous to mention; in fact all painful procedures should be rendered painless if we are to save the shock which would tend to produce a nervous, fearful state, and to save the suffering which unnerves.

And it is no simple problem to accomplish this practically. Local anesthesia is not suitable for the young because of the pain of the primary injection. The skin is the region producing the most reaction. Nor is infiltration of inflamed areas altogether desirable or very effective.

We have in nitrous oxid-oxygen the ideal means if some of the existing difficulties may be overcome; and some of the measures evolved to meet them may be best studied by enumerating what they are.

The first difficulty has been that it required too much time to get things ready. Apparatus has been complicated, requiring mechanical genius or at least experience to get it going.

The second is the need of assistants to cooperate in its administration.

The third is the safty element.

The fourth is the expense incident to its use.

The first or the element of time now favors nitrous oxid-oxygen with modern apparatus as compared with infiltration anesthesia since the latter requires sterilization of needles, preparation of solutions and time for infiltration. With regard to other forms of anesthesia such as morphin-scopolamin and ether there must be added the needed preparation, the prolonged time of induction, and after effects of variable duration.

The safety apparatus which we use[2] has only to be turned on to the required flow. It does not take a minute to have ready. Also it is available away from the equipment for short cases, like paracentesis or abscess drainage, and dressings, by simply loading the bag and detaching it for carrying to the patient. The tight mask and the unleakable bag and attachments make it sure and convenient. During the past three years we have many times taken the loaded bag to the patient's residence for these short operations and for dressings or even for induction of ether anesthesia.

The second difficulty, that of assistants, is not so easy to meet, because certain types of patients do not take any anesthesia well, and require a deal of restraint. But in general and especially with the young who require restraint, what ever is being done, no added help is needed if the apparatus is simple and delivers its ratio of gases without undue attention. We shall see that the trick in this is to get genuine analgesia as we define it and avoid the need of enforced restraint by not going over this borderline.

As to the third or safety elements, these, in nitrous oxid-oxygen anesthesia, are: (A) that no high pressures be ever possible. With 800 and 1,200 lbs. pressure in tanks it is not safe to administer gases without intervening reducing valves and safety devices; and although underwriters class such apparatus as hazardous they are still found frequently in use; (B), we must know that the oxygen and nitrous oxid are flowing as shown by the indicators, and this does not follow in apparata depending upon the opening of valves to greater or less dimensions. If the pressure varies the flow varies, and stop cock and springs and friction valves are not dependable. Types which show actual flow are necessary. This is most important in apparatus for uses of which we are speaking, *i. e.,* where no anesthetist is present, and the practitioner is handling the anesthesia himself; because the second element of safety in nitrous oxid anesthesia is in reality *oxygen.*

Unless there is sufficient oxygen to sustain life there is loss of residual air,—oxygen starvation,—and death results. The requirements of oxygen are not less than one ounce per hour or four gallons by volume. But as there is always loss of gases even with the tightest masks, the allowance in an apparatus for safety should be not less than thrice the actual need, *viz.,* twelve gallons per hour. This must be the actual amount flowing and not simply the amount which *should* be flowing according to an indicator.

There is still another element of both time and

safety in nitrous oxid-oxygen employment, which is that the *analgesic state* is the desirable one to maintain. Analgesia as we define it is a borderline state, *i. e.,* anesthesia just short of unconsciousness without the sensation of pain. "It hurts but you don't feel it!"[3] The ratio of oxygen to nitrous oxid is the determining factor in this[4] and hence must be controlled definitely. Over this borderline is where the patient loses control, fights, resists or what not, if that is his bent.

We do not now think of analgesia as anything short of anesthesia and define as hypesthesia those degrees of lowered pain sensation which are short of anesthesia with consciousness. It would seem better to insist upon this distinction as it is important.

In the minds of the profession the word analgesia has come to signify modified sensation of pain and the term has come to be employed loosely. Analgesia means *without pain* quite as much as anesthesia. We have also fallen into the habit of speaking of degrees of analgesia and of anesthesia. In view of the resulting confusion it would seem proper to limit the term analgesia to loss of sensation without loss of consciousness. This would then apply to local obtunding by infiltration, nerve-blocking or nitrous oxid-oxygen analgesia. Anesthesia would then apply to loss of sensation and also consciousness. It would then be possible to adopt the neurological term hypesthesia for lowered, though not lost sensation and hyperesthesia for heightened sensation.

I am led to believe, therefore, that there is a stage of relaxation with gas-oxygen adequate for any operation without the deep relaxation which injures. It is aided by preliminary medication with morphin and scopolamin one hour before. While we do not yet know just what the objective signs are, some day perhaps we shall learn to maintain analgesia with relaxation,—genuine anesthesia short of unconsciousness,—and then we shall have attained an ideal. Then we shall not have post operative *organ recitals* nor shall we permanently injure our patients, neither their nerve nor their muscle tonus. Toward that end we are tending. Improved technic will, I am sure, help us to attain it and for this we must depend in no small degree upon simplicity, safety, efficiency and accuracy of apparatus.

We cannot know much definitely unless we have an accurate measure of the ratio of gases. Analgesia can be appreciated in no way so well as by self experimentation.

Much may be done with patients in the hypesthetic state (oxygen, 25-40; nitrous oxid, 75-60 per cent.), if they are controlling themselves well, the edge is taken off the pain and it is made more easily endured.

Patients are tided over by it and may be maintained in this state for a long time and then swing into analgesia by lowering the oxygen ratio below 25 per cent. and down to around 15 per cent.; but when we get toward 10 to 5 per cent., general anesthesia with unconsciousness supervenes.* Hence the need of accuracy in measurement of the gases. In the analgetic state, as we define it, the patient feels no pain but is conscious of what is going on, and sufficiently so to respond to suggestion, to do what you tell him, but there being no voluntarily motor control, he will not answer.

With sufficient oxygen in the mixture there is little danger from gas-oxygen. Nitrous oxid contains no oxygen available for respiration. We should really put the matter reversely and say: Enough oxygen must be given to supply respiratory needs and if we supply that we are safe, and having that supply the degree of thesia, whether hypesthesia or analgesia or anesthesia, is determined by the amount of added nitrous oxid. The volume of combined oxygen and nitrous oxid is variable with the depth and volume of respiration. There must be enough flowing to supply the needed volume.

Uncertain measures are not safe. Extraction specialists employing gas without oxygen added would do well to study this exact method. It would save them much hurrying and make their work much easier. With the further addition of suction to carry off the blood from the site of operation as now practiced in tonsillectomies, their difficulties would be minimized and their operations become smooth, safe and dignified procedures throughout.

As to the element of cost. With former types of apparatus the expense was high, due to loss and improper use of gases. Much of this loss was through the improperly fitted mask. Much of it was due to forcing gases to the patient under pressure, so that it came to him even against his expiratory effort instead of merely flowing to the bag, allowing him to breath it naturally. With late models and improved methods we run on less than 50 gallons of nitrous oxid per hour, which is one-third of the early cost. To be exact, we are now running at a cost of about $1.00 per hour, or for short cases of analgesia 10 to 15 cents per patient.

* Increased rate or depth of respiration does not give anesthesia, given a low ratio of nitrous oxid to oxygen less than 80 to 85 per cent. The percentage of oxygen is the controlling factor, not the respiratory function.

As the time saved more than compensates for that, we are no longer thinking of this element.

According to our title we should limit our discussion to analgesia and short anesthesia in routine practice; but by the use of proper technic many cases hitherto thought major types, and indeed made major operations by ether, become minor affairs.

Dr. Ben Morgan, an expert in ether, has made a good point in emphasizing that the athlete who has been completely relaxed and flabby under ether never regains his athletic powers.

We go further and state that no adult who is deeply relaxed comes back with the same muscle tonus,—commonly called *pep*,—whether this relaxation is from ether, a knock-out in the boxing ring, or from tonus killing morphin combinations; nor indeed from relaxing types of pyogenic or exhausting diseases. The athlete knows it because he has reason to. He has certain peak loads to carry which he at once finds he can't do. But the every day fellow finds it out if he watches himself.

As Morgan says, the patient will tell you long after operation, like appendectomy, that he has not been the same since his appendix was removed. The fact is he should date his reversal from the day he was so *ether-logged*.

During the past fifteen months I have had personal experience with nitrous oxid-oxygen having taken it something over fifty times to relieve the excrutiating pain caused by manipulation of a fractured shoulder, and the conclusions to which I have come are: that anesthesia with consciousness is possible; that in this state the subjective sensation of pain is present but is not felt; also that relaxation is on this borderline and that the percentage of oxygen in the mixture is always the determining factor.

References.

1. George W. Crile: A Mechanistic View of Peace and War, 1915, 28-30.
2. An Apparatus for the Administration of Gas-Oxygen. New York Medical Journal, Feb. 19, 1916.
3. Will Walter: Trans. Amer. Acad. Opthal. & Oto-Laryng. 1915.
4. Symposium on Anesthesia. Chicago Medical Recorder, June, 1918.

THERE IS A SHORTAGE OF QUALIFIED AND LICENSED ANESTHETISTS. TO FILL THE NEED STIMULATE THE INTEREST OF SOME PHYSICIAN OR DENTIST IN YOUR HOME TOWN IN TAKING UP THE SPECIALTY. HELP HIM TO LAUNCH HIMSELF SUCCESSFULLY AND BRING HIM IN AS A MEMBER IN ONE OF THE ASSOCIATIONS OF ANESTHETISTS. THE EFFORT WILL REPAY YOU IN MANY WAYS.

LOCAL ANESTHESIA FOR PENETRATING BRAIN WOUND OPERATIONS.

Major Harvey Cushing, director of U. S. Army Base Hospital No. 5 in France, has enjoyed clinical advantages that make his contribution on Penetrating Brain Wounds (*British Medical Journal*, February 23, 1918) of much more than ordinary interest. Aside from the purely surgical features of Cushing's conclusions, drawn from an experience of some 225 recorded cases, his use of local anesthesia is perhaps the most significant point in the technic of his operative procedure.

During the shaving of the head, possibly an hour before the patient's turn will come, a sedative is given, 1/3 grain of omnopon (pantopon) usually being sufficient, though this may be repeated if the patient is very restless or obstreperous. Then 15 or 20 minutes before the operation, in the lines of proposed incision, Cushing infiltrates the scalp with a 1 per cent. procain and adrenalin (15 drops to 30 cc.) solution in the sub-aponeurotic layer.

There exists a difference of opinion regarding the relative merits of general versus local anesthesia for cranial operations. Cushing confesses to an original prejudice in favor of inhalation narcosis, but his experience in war surgery has led him completely to alter his view.

General narcosis increases intracranial tension, which exaggerates the difficulties of an operation already difficult enough. It increases bleeding from the scalp, which, with the procain-adrenalin solution is rendered negligible. It encourages the use of rougher methods, which a patient under local anesthesia would not tolerate, and which, therefore, are in all likelihood harmful. It encourages speed, which is to be decried if employed at the expense of delicacy. It leaves many patients, particularly those with threatened respiratory difficulties, in a condition in which inhalation troubles are prone to occur.

Until recovery from a general anesthetic is complete every patient should be under close observation, and this, at a casualty clearing station at least, is impossible. It is very rare, and then only in case of semi-conscious patients or those with restless irritability, that the operation cannot be carried through under local anesthesia, though this necessitates more gentle manipulations than those usually employed, particularly during the process of removing the area of cranial involvement.

Colonel H. M. W. Gray, R.A.M.C., has found omnopon (pantopon) preferable to morphin for pain relief and alkaloidal amnesia, because its depressing effect on the vital centers and on metobolism is not manifest to anything like the same degree. Two-thirds of a grain of pantopon is equivalent in sedative action to about ¼ to 1/3 grain of morphin.

J. Anderson (*British Medical Journal*, July 14, 1917), adds magnesium sulphate to his local analgesic solution, utilizing the following formula:

Procain	0.75 per cent.
Magnesium sulphate	0.50 per cent.
Normal saline .....100.	per cent.

To each 30 mils of this solution 1 mil of adrenalin solution (1 to 1000) is added. This provides a somewhat longer duration for the obtunding effect.

The main features of the routine procedure for handling penetrating brain wounds developed by Cushing from his extended experience and those of other operators, are as follows: (1) The removal *en bloc,* rather than piecemeal, *of the area of cranial penetration.* (2) The detection of the in-driven bony fragments by *catheter palpation* of the track, rather than by the exploring finger. (3) The *suction method of removal of the disorganized brain,* thereby cleansing the track of the so-called pulped or devitalized tissue, the retention of which, as is the case with dead tissue anywhere, favors infection. (4) The use of *dichloramine-T in oils as an antiseptic* particularly suitable for infections in the central nervous tissues.

In addition to these more essential features of the operative procedure, the routine preoperative neurological study of the case; stereoscopic *x*-ray negatives; the shaving of the entire scalp; the invariable use of *local anesthesia* supplemented with alkaloidal amnesia; preferential tripod rather than flap incisions; foreign body extraction with the magnet when possible; closure of the wounds with buried sutures in the galea; the dressing of all serious cases in the operating room rather than in the wards —all these steps, though less novel, were found to be contributory to the successful outcome of the more severe cases.

By utilizing two or three tables for each operating team, series of cases may be handled without delay, the neurological examination, *x*-ray exposure, shaving of the scalp, hypodermic and local anesthesia injection, all of which are time-consuming, being carried out during the operating period of the previous case.

It is to be noted especially that Cushing's entire technic has been an elaboration of the velvet-touch method of operating, which is an essential for all procedures done under local anesthesia. In this connection it should also be emphasized that the use of alkaloidal amnesia, puts the patient in a sufficiently drowsy condition not to mind the use of trephine, drill, or ronguer, the effects of which are somewhat distressing when local anesthesia is used alone.

The summary of the results of examinations of blood presure in head wounds, in the report of the British Medical Research Committee, December 25, 1917, is of interest in connection with the subject under discussion. Fraser and Cowell conclude that:

The blood pressure subsequent to wounds of the head is apt to be unstable. If operation is performed under general anesthesia before the blood pressure has become stable, disaster is liable to ensue. The possibility of such an ill result can be diminished by delaying operation until the blood pressure has become stable or *by performing it under local anesthesia, supplemented with scopolamin-morphin.*

THE AUSCULTATORY CONTROL OF VAPOR ANESTHESIA.*

ARTHUR E. GUEDEL, M.D.

Captain U. S. Army Medical Corps, Base Hospital 23, American Expeditionary Force, France.

INDIANAPOLIS, IND.

In an effort to meet a shortage of proper anesthesia apparatus for head surgery in the American Expeditionary Force, and at the same time provide a suitable device for the administration of the accepted high-volume, low-tension ether vapor for operations about the head and face, by the intrapharyngeal method, the illustrated apparatus was assembled from material that every base hospital has in stock. With a photo or drawing of this device at hand its assembling should not take more than an hour's time.

The apparatus supplants the high-priced and complicated (but good) devices now on the market for anesthesia in head surgery and produces results equally good in a simpler manner. The anesthetic novice will learn to operate it much more readily than the more intricate devices. Also the auscultatory tube, which is a feature in intrapharyngeal anesthesia that, I believe, has never before been used in this way, is a great help in the maintenance of an even and light anesthesia. It is of particular value in the dark-room for the removal of foreign bodies about the head, under fluoroscopic control. In fact it was the need of some method of control in dark-room anesthesia that prompted the conception of the auscultatory tube for this purpose. It has worked out so well that it has been used in anesthesia for general surgery as well as to facilitate the maintenance of even anesthesia.

There is less ether wasted with this apparatus than with those devices which employ a hot place for the vaporization of the ether.

The apparatus consists of: (1) A dental foot-bellows; (2) a rubber tube, through which air is carried into the other container. By manipulating the Dakin clamp on this tube the percentage strength of the ether vapor is controlled by regulating the amount of air passing through the ether; (3) A rubber tube through which a stream of air passes to the patient without passing through the ether container. By manipulating the Dakin clamp on this tube, in a direction contrary to that of the inlet tube, the strength of ether vapor delivered to the patient may be further controlled; (4) a

*Read by proxy during the Fourth Annual Meeting of the Inter-State Association of Anesthetists, in conjunction with the Indiana State Medical Association, Claypool Hotel, Indianapolis, Ind., Sept. 25-27, 1918.

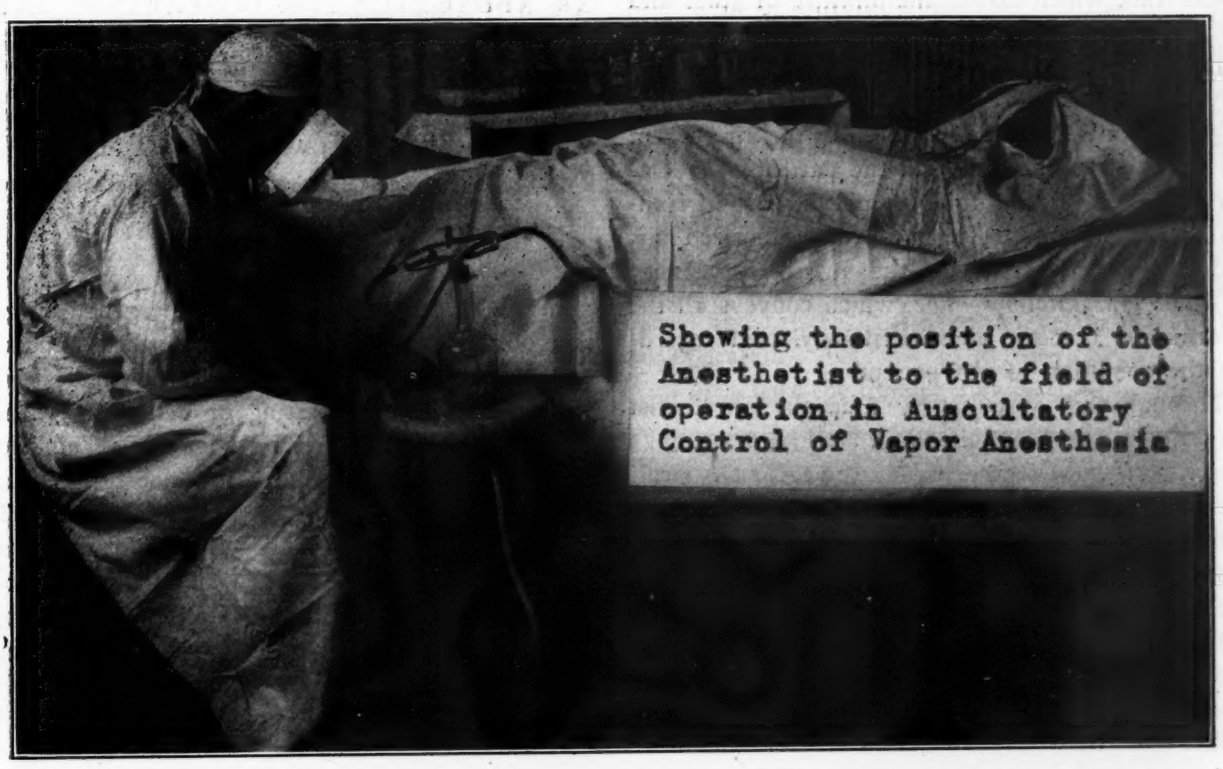


Fig. 1. Showing the position of the Anesthetist to the field of operation in Auscultatory Control of Vapor Anesthesia.

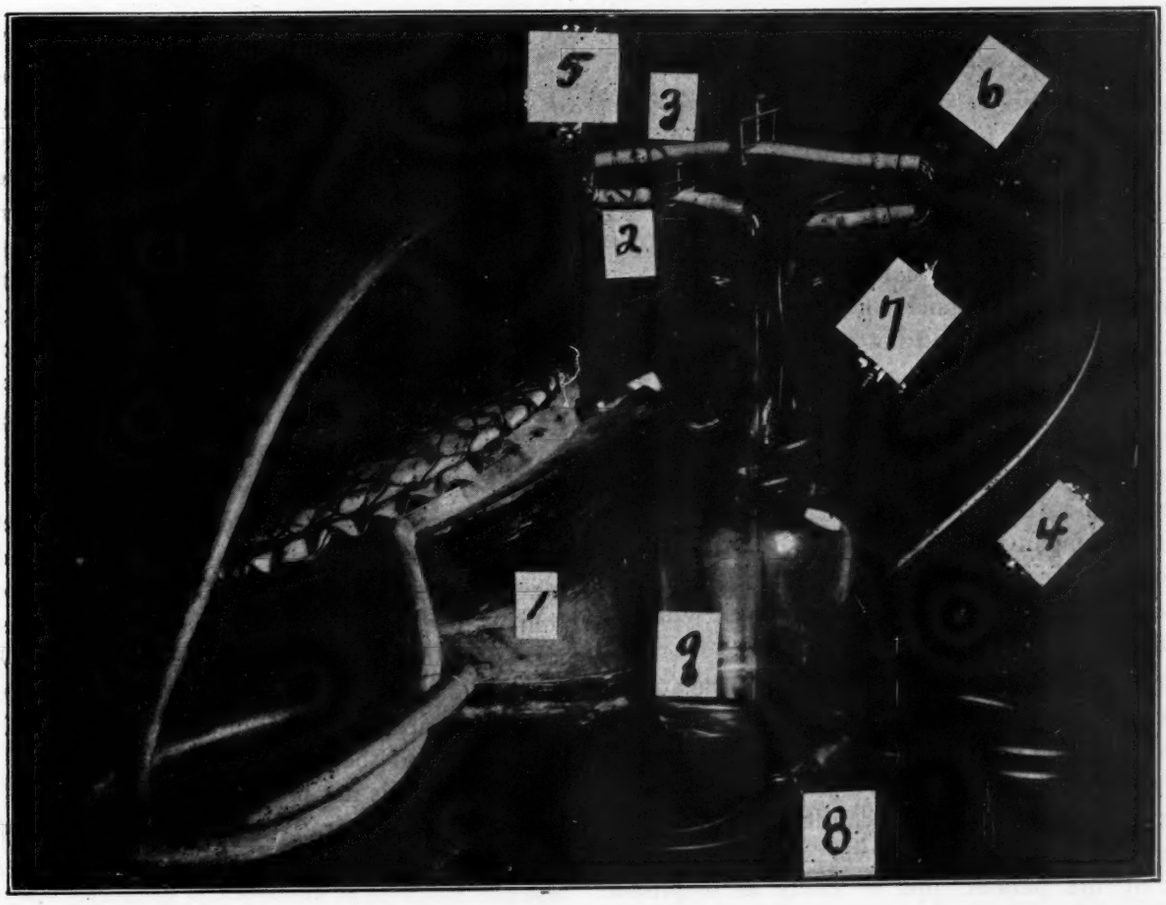


Fig. 2. Close-up of Apparatus fully assembled.

rubber tube which carries the mixture of ether and air to the patient. This tube is 4 feet in length, thus enabling the anesthetist to sit well out of the way of the operators; (5) Dakin *U* glass distributing tube for the purpose of dividing the air current between the ether bottle and the patient; (5) Dakin *3Way* distributing tube for the purpose of combining the streams of pure air and etherized air, and for the connection of the auscultatory tube; (7) The *Auscultatory Tube,* which conveys all the information that the anesthetist may need regarding the condition of the patient.

Through this auscultatory tube the anesthetist may determine the following: (a) the patient's respiration; (b) whether or not the patient is swallowing, or (c) the patient's larynx is being flooded with mucous. This complication is rare with the high-volume, low-tension ether vapor method of anesthesia, because the end openings of the nasal tubes, when in position, are just above the larynx and the volume of etherized air is sufficient in most cases to blow all excess mucous into the mouth, from which it is either allowed to drain or is milked-out by pressure of the cheek; (e) the slightest effort of the patient to cough or vomit, indicating too light anesthesia, a matter that may be immediately remedied by deepening the narcosis; (f) the amount of air bubbling through the ether, thus helping to ascertain the strength of the ether vapor. This strength may also be determined by removing the auscultatory tube from the ear and smelling the ether vapor flowing through the tube, as it is always the same percentage strength as that being delivered to the patient. This auscultatory tube is particularly valuable in dark-room work, such as the removal of shrapnel under the fluoroscope. Here the anesthetist need not see the patient at all. He conducts the anesthesia entirely in accordance with the signs obtained through the auscultatory tube; (8) Dakin *U* tube connected with two catheters which are passed through the nostrils into the pharynx, and (9) the ether container.

The accompanying photograph shows the position of the anesthetist and apparatus with relation to the patient and the field of operation, with the auscultatory tube in place.

In conclusion, it may be remarked that the auscultatory tube furnishes more definite information as to what is going on in the patient's throat and chest than can be had in any other way, not excluding the use of the stethescope continuously over the chest. In cases where it is necessary to watch the pulse of the patient, this is easily accomplished at the wrist on the radial artery.

AN APPARATUS FOR DOSIMETRIC ANESTHESIA FOR FIELD AMBULANCE, EMERGENCY SURGERY AND OBSTETRICAL USE.*

M. L. TOWNSEND, M.D.

Captain, U. S. Medical Corps, Field Ambulance Service, American Expeditionary Force, France.

CHARLOTTE, N. C.

In Field Ambulance service, emergency surgery and obstetrics the physician or medical officer is repeatedly confronted with the problem of giving an anesthetic and operating or delivering without an assistant, either skilled or otherwise. This necessity prompted the designing of an anesthetic inhaler as automatic and dosimetric as could be made. The inhaler, herewith presented, is simple, compact and always ready for use. It is an inhaler and container combined and packs into so small a space that it may be carried in the pocket or emergency grip, filled and ready for instant use.

It furnishes a steady, uniform, dosimetric vaporization of the anesthetic without requiring any dropping of the agent; and can be automatically set to deliver certain percentage strengths of the anesthetic used.

As the accompanying illustrations show, the inhaler is composed of a mask and container. When closed the container screws into the mask, sealing itself so that the ether or chloroform within neither evaporates nor deteriorates. To prepare the inhaler for use the container is unscrewed from the cap inside the mask and engaged in the outer socket and screwed into place so that the O of the dosimetric scale is opposite the nasal end of the mask. The mask is so modeled that it will fit any sized face and nose without the need of a rubber air cushion or gauze sponges. The inhaler is indestructible and can be washed or sterilized in any desired manner without fear of damage.

The inside of the container is fitted with sheet metal, concentric rings, covered with absorbent material. These concentric rings are so arranged that when engaged, with the mask in use, the vaporization of the anesthetic may be controlled dosimetrically by turning the container on the mask, either to right or left, as a stronger or weaker concentration is desired. The contents will not spill out irrespective of the position of the inhaler.

This device is not only simple, sensible and practicable, but comparatively reasonable in cost. It

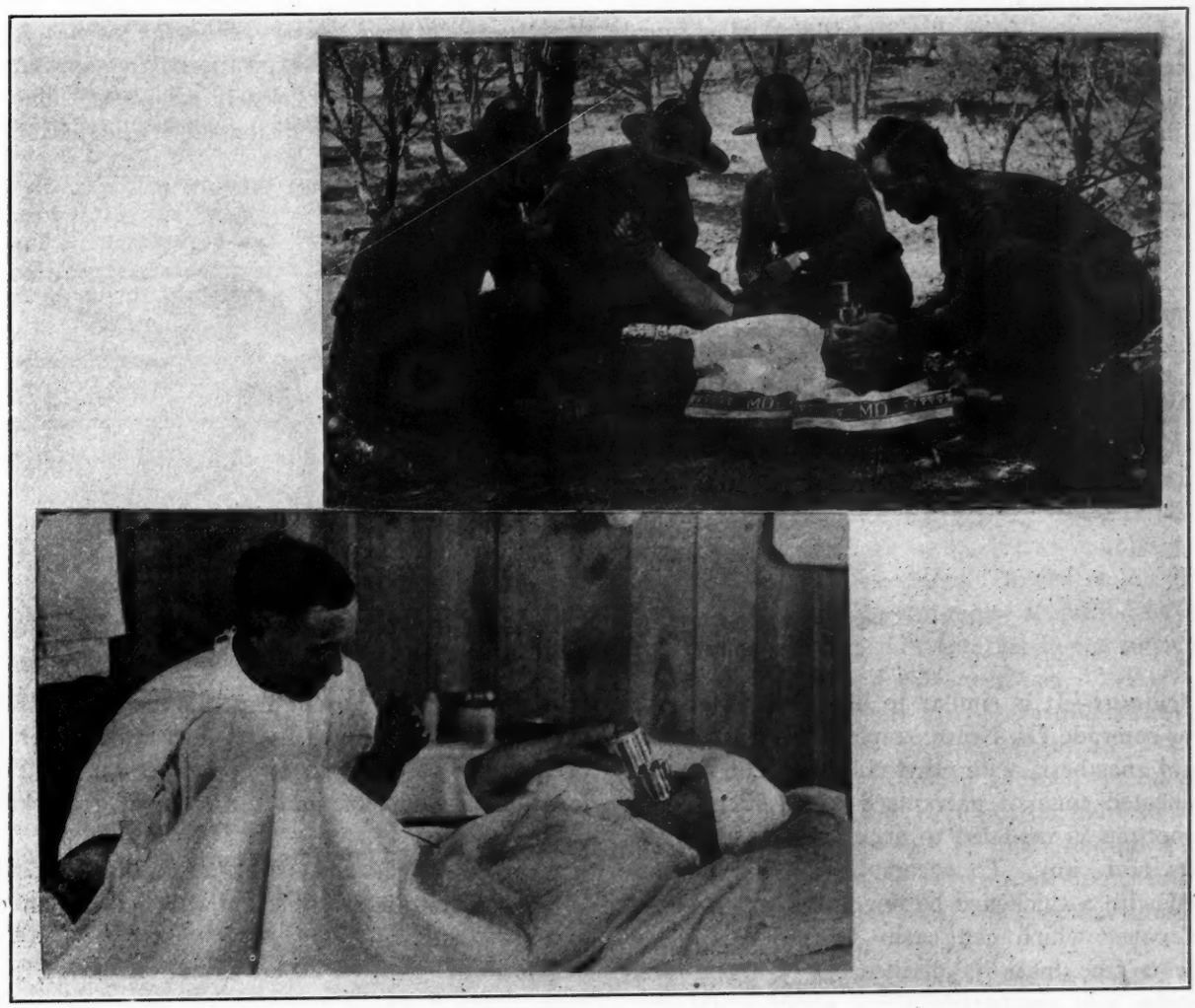
*Read by proxy during the Fourth Annual Meeting of the Interstate Association of Anesthetists, in conjunction with the Indiana State Medical Association, Claypool Hotel, Indianapolis, Ind., Sept. 25-27, 1918.

requires no renewal of its absorbent material and as there are no complicated parts to get out of order, its upkeep is negligible. Also it will induce and maintain anesthesia with about one-half the amount of any anesthetic required by open methods of anesthesia and this advantage makes for economy.

Its greatest advantage, however, is the increased safety to the patient. Because of the uniform, dosimetric anesthetic vapor provided, there is no *coming out* one minute and *drowning* the next. The operation of the inhaler is so simple that any anesthetist, even a novice, may expect satisfactory results.

tions with their stomach full of slumgullion, and in spite of this lack of preparation for an anesthetic, the use of this inhaler, providing a minimal dosage and absorption of the anesthetic, has been followed by a very low percentage of after-nausea. While the percentage strength of anesthetic vapor must be rather rapidly raised during induction, the patient's more or less fixed dosimetric requirement during the stage of maintenance is readily determined and can be kept at that level to the end of the operation.

In obstetrics the inhaler may be used by the par-



Figs. 1 and 2. The Townsend Inhaler in use in Field Ambulance Service and in Obstetrics.

The container will hold approximately 100 cc. of ether, chloroform or anesthol and if the anesthesia is of sufficient length to exhaust this amount, the container may be immediately refilled by using the mask as a funnel.

In Field Ambulance service, or emergency surgery, whether of a military or civilian sort, this inhaler, in the originator's personal experience, has satisfactorily met all demands made upon it. Soldiers in service almost routinely present for operaturient woman herself, after the dosimetric requirement to obtund the pains of labor has been determined. There is no danger of overdosage, for with waning consciousness and the onset of relaxation the inhaler drops away from the patient's face, to be reapplied by the woman at the next pain. The dosimetric requirement for continuous, light anesthesia during delivery may be determined by the obstetrician and maintained by an attendant holding the inhaler in place.

GENERAL ANESTHESIA IN WAR SURGERY.

P. PICARD.

Interne des Hôpitaux de Paris, Médecin Aide-Major.

This procedure, inspired by that of our preceptor, M. Savariaud, (*La Presse Medicale,* No. 55, 1917), has rendered us the greatest service during the most intense activity of our Unit. Since January, 1917, we have employed it exclusively for all our general anesthesias.

Simplicity and rapidity of anesthesia, without complicated apparatus so difficult to procure, are of great importance from the standpoint of surgical service. It is on this account that we recommend this simple, convenient and easily-constructed apparatus.

Fig. 1.

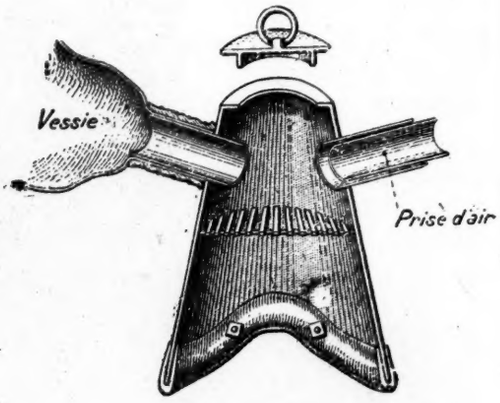


Fig. 2.

Apparatus—It is similar to but larger than that of our comrade Dr. Noiré, employed for prolonged, general anesthesia with ethyl chlorid. The mask is a truncated cone of galvanized metal 12cm. high. The bottom is modeled to accurately fit the nose, cheeks and chin. To accomplish this it is reinforced with a thickened border. The top is closed by a cover which can easily be removed. The inside o fthe mask is divided, by a metal-mesh partition, into compartments of about equal size. The upper compartment is the resorvoir for the anesthetic. Near the top and to the left it is connected with a rebreathing bag (as in the Ombrédanne and Camus inhalers), so that the respiration may be partially or entirely confined. Symmetrically and to the right is an air-vent, easily regulated, formed by two sleeved tubes, with overlapping openings 2 cm. by 0.007 mm.

Anesthesia.—The choice of the anesthetic is not indifferent. We employ exclusively Schleich's Mixture (ether 60 grams, chloroform 20 grams and ethyl chlorid 10 grams), which is easily made. For a long time J. Louis Faure has drawn attention to this mixture. Upon the anesthetic table is a graduated glass and flask of Schleich Mixture, prepared in advance. When everything is in readiness for the operation, and the wounded patient has been placed on the table, the apparatus is charged. Two medium-sized, fluffed compresses of gauze (which are renewed for each operation), are placed in the reservoir, and saturated with 20 cc. of the mixture, poured from the graduate through the top aperture.

The cover is closed, the inhaler is gently placed over the face *with the air-vent wide open.* After two or at most three expirations, the air-vent is closed and the inhaler closely adapted. The rebreathing bag is fully distended. The period of excitation is either absent or negligible, even in alcoholics. In two minutes the time necessary for the preparation of the field of operation, muscular relaxation is complete, and the narcosis remarkably calm.

After the operation is begun nothing remains but to maintain anesthesia and watch the condition of the patient.

The initial dose of 20 cc. assures a period of at least from 8 to 10 minutes of anesthesia, after which, to maintain anesthesia, it is necessary to add 5 cc. of the mixture every 7 minutes. This dosimetric administration of the mixture is accomplished through the upper aperture of the inhaler without displacing it.

Ordinarily the air-vent remains completely closed, and is only opened when necessary.

The return to consciousness is rapid and complete. Nausea is rare and vomiting not more frequent than with chloroform. We have administered 500 anesthesias without untoward incident.

American Journal of Surgery

QUARTERLY SUPPLEMENT *of* ANESTHESIA *and* ANALGESIA

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F. HOEFFER McMECHAN, A.M., M.D., *Editor*

Avon Lake, Ohio, U.S.A.

JANUARY EDITORIALS. 1919.

THE UNIVERSITY OF CALIFORNIA ESTABLISHES POSTGRADUATE INSTRUCTION IN THE SPECIALTY OF ANESTHESIA.

In Official Bulletin No. 18, W. E. Musgrave, Supt. of the University of California Hospital, announces the establishment of postgraduate instruction in the specialty of anesthesia. This course is in addition to the instruction in anesthesia given medical students and interns and is open to physicians who are graduates from schools acceptable to the hospital and who furnish satisfactory evidence of uprightness and health. The duration of the course is three months and is repeated three times a year, as follows: June, July, August; October, November, December; and February, March, April.

Classes are limited to four. Lectures and demonstrations are given in the afternoons and practical work during the morning hours. The following is a brief outline of the course: (1) History of Anesthesia; (2) Ethics of Anesthesia, including the relation of the Anesthetist to the Surgeon; (3) Physiology of Anesthesia; (4) Properties of various Anesthetic Agents; (5) Choice of Anesthetics; (6) Anesthetic Emergencies; (7) Modern Anesthetic Apparatus and Its Uses; and (8) Anesthetic Records.

The practical work includes the giving of anesthetics under the supervision of one of the teachers and will be arranged for in the University of California Hospital and other institutions.

The instruction is in charge of Dr. Mary E. Botsford, Chief, and Drs. Mary Kavanagh, Henrietta Duggan and Mary Turnbull Murphy, Assistants.

The University of California is to be congratulated on its progressive attitude in establishing this course. Medical schools have too long neglected the opportunities that lie open to some of their students and graduates in the specialty of anesthesia. It is also a striking sign of the times that this course should be entirely under the control of a group of noted women physician anesthetists of San Francisco. The EDITOR looks forward to the immediate and continued success of this venture.—McM.

A THOROUGH KNOWLEDGE OF THE SPECIALTY OF ANESTHESIA AND ANALGESIA.

Several years ago the EDITOR of the SUPPLEMENT pointed out the advisability of specialists in anesthesia acquiring a thorough knowledge of both general and local anesthesia. Not long since Willy Meyer of New York has emphasized the fact that all large hospitals should have on their staffs some one or more members who are entirely familiar with the technic of local anesthesia as it applies to routine operative procedures. Meyer makes this suggestion because the surgeons are still few and far between who take any interest in the intricacies of either general or local anesthesia. While a larger number of surgeons are interesting themselves in local and regional anesthesia, not all of them acquire the knack of using these methods satisfactorily and not a few have not the time to waste on using local anesthesia. In this situation it is up to the anesthetist who wishes to be a full-fledged specialist to master local and regional anesthesia as well as general narcosis.

As an evidence of how such a specialist is of peculiar value the EDITOR would point out the fact that during the mobilization of the Anesthetic Service for the medico-military establishment a certain member of the Associated Anesthetists was detailed to one of the largest cantonment Base Hospitals to supervise its anesthetic service. At the time an epidemic of broncho-pneumonia had left in its wake many cases of empyema, requiring operative interference. Ordinarily these cases would have been handled under some method of general anesthesia to the great discomfort of the soldier patients. The anesthetist in question, however, was

an all-around specialist and suggested that the necessary rib-resections be done under local anesthesia, and his suggestion was not only accepted, but he was given the opportunity of personally doing the work. Sixty costallectomies were thus satisfactorily done under local anesthesia to the gratifying satisfaction of all concerned.

During the waiting period of the local anesthesias and the time of operation this anesthetist supervised the nitrous oxid-oxygen anesthesias, given by his assistants, in the other operating rooms. Such service wins its own way, not only in the medico-military establishment but in civilian hospitals as well.

It must be remembered, however, that local and regional methods of anesthesia require intensive study and prolonged experience before they can be mastered and the successful anesthetist cannot afford to stop short of mastery. Some dentist anesthetists have already accomplished much in this direction in their special line of work and the field is wide open to the progressive anesthetist who wishes to seize the opportunity, not only in his hospital, but also in his downtown anesthesia clinic.—McM.

IN MEMORIAM.

CAPTAIN CHARLES H. GALLAGHER, M.R.C., U. S. Army, Base Hospital 202, ORLEANS, FRANCE.

Captain Charles H. Gallagher, M.R.C., is the first member of the Associations of Anesthetics to give his life for his country. After a very brief siege of pneumonia he succumbed at Orleans, France, August 26, 1918, while on duty at Base Hospital 202. Captain Gallagher was born in Slaterville Springs, New York, October 6, 1876. He graduated at the Ithaca High School and later took his medical degree at Syracuse University.

Upon recommendation of the Association of Anesthetists Dr. Gallagher was commissioned in the medical reserve corps and began with a tour of duty at Ft. Oglethorpe, Ga., after which he was ordered to a replacement battalion at Allentown, Pa., later sailing for England and thence to France, where he was a member of the staff of Base Hospital 202 at Orleans, until his untimely death.

Captain Gallagher was an expert anesthestist, being a member of the American, New York and Interstate Associations, and had practiced this specialty for some time, and it is thought by his father, Dr. William G. Gallagher of Slaterville Springs, that his constitution might have been weakened by his constant administration of anesthetics. In the last letter received from Captain Gallagher he wrote that he was kept busy as patients were being brought in at the rate of about 100 a day.

Fortunately Chaplain Arthur W. Moulton has been able to give us details regarding Captain Gallagher's illness and death. He writes:

"It was my privilege to minister to Capt. Gallagher during his illness and I visited him each day. His illness was of short duration and he was unable to resist it. I had several services with him, which, he said, made him very happy. I gave him Holy Communion and was with him much of the time. He passed away peacefully without suffering. His funeral was most impressive. He had made so many friends among the French people here that they attended in large numbers and sent most beautiful flowers. The French Staff sent a large escort of soldiers and lovely bouquets. The officers here acted

CAPTAIN CHARLES H. GALLAGHER, M.R.C.,
U. S. Army, Base Hospital 202,
ORLEANS, FRANCE.

CAPT. GALLAGHER IS THE FIRST GOLDEN STAR IN THE SERVICE FLAG OF THE ASSOCIATED ANESTHETISTS.

as pallbearers and the entire body of American soldiers marched to the cemetery. The funeral service was that of the Episcopal Church and in addition there was read by one of the Captains the ritual of the Masonic Fraternity. The services were held at the Hospital and the grave. The casket was covered with a beautiful silk flag and a gorgeous Tricolor of France."

The following translation from a French newspaper of Orleans expresses the sense of loss of the foreign community that had learned to love him:

"Yesterday at 3 o'clock were held the obsequies of an American, Captain Charles H. Gallagher, M.D., attaché of Base Hospital 202. He was ill only four days with double pneumonia. The services were conducted by the Commandant, Major Bishop, and followed by a large audience. Before the tomb at the American cemetery, M. Boissin presided very devotedly at the French ceremony and spoke a few words to render homage to the deceased, who leaves a wife and two small children. Dr. Gallagher was 42 years of age. He was exceedingly kind to the wounded and sick and he seemed to reflect the animated affection which he had for his own children upon the French children who surrounded him. The words of M. Boissin deeply moved the mourners and we join with him in addressing condolence to the comrades, friends and family of Dr. Gallagher. They will find here the testimony of our gratitude and the part we take in their sorrow, which is also ours."

In a personal letter, Mr. J. D. Prigmore, American Y. M. C. A. Secretary, pays the following tribute to the deceased:

"Captain Gallagher was one of those persons we can ill afford to lose *over here just now.* It is true he had his skill and his profession and he gave himself unsparingly as a doctor; but that was only one part of his great service to us here. When the last word is spoken in the affairs of this war the biggest asset is *personality.* Captain Gallagher had the personality of giving himself to others. Officers and men alike received from him sprightliness and good cheer. The enlisted men all loved him and found him so approachable. When they had no Y. M. C. A. nor Red Cross here, he headed-up the athletics and sports for the fellows. Always his face was beaming with cheer and sunshine though driven with much work and responsibility. As supply officer, in addition to his other duties, he was much in contact with the French army and civilian officers. He was widely known and respected in this beautiful, cultured city. Many of the finest homes were open to him and the French children loved him. Remember that personality cannot die, and that that which was finest in Captain Gallagher will continue to serve and work in this hospital and communiy."

That Captain Gallagher was very popular with his fellow officers and associates is shown in Major Shearer's letter, announcing his death:

"I am writing this from the American Officers Club, where Capt. Gallagher had endeared himself to all who met him, both professionally and personally. Would that you could hear them speak of him as I have done this morning and you may be sure that his last resting place has been hallowed by the prayers and the tears of Americans and French alike. No one of us knows whose turn to be called comes next and we shall all respond as he did."

Captain Gallagher had much to give and he gave it unstintedly. A devoted husband and father, a successful practitioner, rich in friendships, a bright career in his specialty before him, he gave up much more than many men can ever give to do his part in this war for a great ideal. Now he has joined that company of brave spirits who, having subordinated all they hold most dear to their country's cause, have made in its behalf the Supreme Sacrifice. A nation that has men like these shall never die; a cause for which such men go gladly to death is bound to triumph.

The specialty of anesthesia and its Associations, which lose so heavily by his going, have a solemn pride in the thought of giving such a man to the nation. His memory will always be a precious heritage.—McM.

Society Proceedings

Membership in a society devoted to your specialty is an essential to success.

INTERSTATE ASSOCIATION OF ANESTHETISTS FOURTH ANNUAL MEETING.

The Fourth Annual Meeting of the Interstate Association of Anesthetists was held in the Claypool Hotel, Indianapolis, Ind., Sept. 25-27, in conjunction with the Indiana State Medical Association.

The Executive Session was called to order by Dr. E. I. McKesson, Chairman. The minutes of the previous meeting as well as the report of the Secretary-Treasurer were accepted as read. Resolutions offering the continued support and cooperation of the Interstate Association to the Surgeon General were unanimously passed. Resolutions of condolence were passed on the untimely death of Capt. Chas. H. Gallagher, M. C., U. S. Army, representing the first golden star in the Service Flag, and conveyed to the family of the deceased.

The following were elected to membership: Drs. R. Stuart Adams, San Antonio, Texas; Geo. M. Alexander, Bronx, N. Y.; Harry R. Barclay, Dayton, O.; Denny B. Beattie, St. Joseph, Mo.; Justin W. Bourquin, Tidionte, Pa.; Leon D. Bryant, Syracuse, N. Y.; Ola Buckman, Toledo, O.; C. H. Burmeister, Cincinnati, O.; A. G. Cashbaugh, Columbus, O.; S. C. Clemans, Gloversville, N. Y.; Samuel Cohen, Cleveland, O.; M. J. Cramer, Cleveland, O.; Taylor Davidson, Sidney O.; S. Griffith Davis, Baltimore, Md.; Leo Doran, Montreal, Canada; James K. Duff, LaGrange, Ind.; H. R. Francis, Toledo, O.; M. H. Feldman, New York City, Jas. A. Flanagan, Shenandoah, Pa.; L. F. Frurip, Kendalville, Ind.; Henry J. Gibbins, Newark, N. J.; G. F. Gilliam, Moline, Kan.; Louis Greenblum, Columbus, O.; Clarence A. Hill, Buffalo, N. Y.; Walter J. Hodson, Dallas, Tex.; T. H. Hurst, Alden, Ia.; R. B. Harvey, Herrington, Kan.; H. R. Isenhower, Bloomfield, Ind.; Robt. E. Jameson, Davenport, Ia.; Marie B. Kast, Indianapolis, Ind.; Chas. B. Kelley, Jersey City, N. J.; Clyde W. Kirkland, Columbus, O.; H. Krause, Burnham, Ills.; C. A. Lambdin, Vincennes, Ind.; Iva M. Lickly, Lima, O.; Jos. E. Lumbard, New York City; Arnold J. Mackay, New York City; J. W. McHatton, Rockville, Ind.; Alex. S. McCormick, Akron, O.; James L. Meikle, Cleveland, O.; H. E. Mitchell, Lancaster, Mo.; Dee Morrow, Fond lu Lac, Wis.; Virgil B. Newell, Stafford, Kan.; Roy A. Ober, Akron, O.; Wm. W. P. Penske, Toledo, O.; John H. Reagan, Grand Island, Neb.; Olin W. Rogers, Knoxville, Tenn.; W. H. Sargent, Toledo, O.; E. E. Stewart, Akron, O.; Lamora Shuey, Toledo, O.; M. L. Townsend, Charlotte, N. C.; R. W. Weaver, McKeesport, Pa.; Pina M. Welborn, Los Angeles, Cal.; C. W. Wilkinson, Sioux City, Ia.; Julian A. Zabrocki, Chicago, Ill.; Henry F. Nolting, Indianapolis, Ind.; Bella Lewison. Erie, Pa.; Carl D. Lucas, Indianapolis, and Thomas A. Young, Toledo O.

The following officers were elected for the 1919 meeting: Drs. John J. Buettner, Syracuse, N. Y., Chairman; W. I. Jones, Columbus, O., Vice-Chairman; F. H. McMechan, Avon Lake, O., Secy.-Treasurer; and B. H. Harms, Omaha, Neb., Henry F. Becker, Danville, Ills., Geo. B. Winter, St. Louis, Mo., Louis H. Maxson, Seattle, Wash. W. F. Dramburg, Milwaukee, Wis., and Isabella C. Herb, Chicago, Ills., members of the Executive Committee.

The next place of meeting, as usual, was left to the discretion of the Executive Committee and Officers.

The following Program was presented, the papers of those in active service being read by proxy:

Address of Welcome and Presentation of Gavel, John Barnhill, M.D., Indianapolis, Ind. What the Expert Anesthetist Should Be, Alex. S. McCormick, M.D., Akron, O.; The Anesthetist on the Hospital Staff, Isabella C. Herb, M.D., Chicago, Ills.; The Downtown Anesthesia Clinic, Ralph M. Waters, M.D., Sioux City, Ia.; Organizing the Specialty of Anesthesia, F. H. McMechan, M.D.,

Avon Lake, O.; Anesthesia in War Surgery, C. N. Combs, M.D., Terre Haute, Ind., A. E. Guedel, M.D., Indianapolis, Ind., A. E. Rockey, Portland, Oregon, and M. L. Townsend, M.D., Charlotte, N. C.; Vapor Anesthesia for Oral and Facial Surgery, Wm. H. Long, M.D., Louisville, Ky.; Limitations and Psychic Factors of Nitrous Oxid-Oxygen Anesthesia and Handling the Obstreperous Dental Patient, W. F. Dramburg, D.D.S., Milwaukee, Wis.; Nitrous Oxid-Oxygen Anesthesia for Difficult Extractions, H. R. Francis, D.D.S., Toledo, O.; Ether Hypnosis in Psychotherapy, F. R. Starkey, M.D., Detroit, Mich.; Why Anesthetics Act, W. E. Burge, M.D., Urbana, Ills.; Some Improved Methods and Apparatus for Experimental Anesthesia, John A. Higgins, M.D., Chicago, Ills. The Physio-Pathology of Ethyl Chlorid Anesthesia, E. H. Embley, M.D., Melbourne, Australia; The Influence of Chloroform on the Stability of Red Blood Cells, E. Silberstein, M.D., Cincinnati, O.; Ether Therapy in Tuberculous Infections, W. E. Savage, M.D., Cincinnati, O.; Nitrous Oxid-Oxygen Anesthesia in Ceserean Section and Operative Obstetrics, E. I. McKesson, M.D., Toledo, O.; Cotton-Process Ether and Ether Analgesia, James H. Cotten, M.D., Toronto, Canada; Factors of Safety in Hysterectomy, Donald Guthrie, M.D., Sayre, Pa.; A Clinical Study of Blood Pressure, Pulse Pressure, and Hemoglobin in Postoperative Shock, Hemorrhage and Cardiac Dilatation, John O. Polak, Brooklyn, N. Y.; and Anesthesia in the Curriculum and Clinic, W. D. Gatch, M.D., Indianapolis, Ind.

The Annual Dinner was served on the evening of Sept. 25, was well attended and enjoyed by all. Dr. G. W. H. Kemper, a Civil War Veteran, was the speaker of the occasion and dwelt on the thread of anesthesia as it had run through his long professional life. The ladies were delightfully entertained during the meeting.

Quarterly Index

Of the Current Literature of Anesthesia and Analgesia.

ALCOHOLIZATION, DIRECT, OF SENSORY ROOT OF FIFTH NERVE IN TREATMENT OF TIC DOULOUREAUX. H. H. Martin, Savanah. Georgia State Medical Association Journal, August, 1918.

ANESTHESIA, GENERAL, IN WAR SURGERY. P. Picard. Presse Medicale, July 4, 1918.

ANESTHESIA, GENERAL, TREATMENT OF EIGHT CASES OF CONCUSSION APHASIA. By L. H. S. Bholaraskssha. Medical Journal Siamese Red Cross, Bangkok, April, 1918.

ANESTHESIA, SURGICAL. Henry O. Marcy, Boston, Mass. Urologic and Cutaneous Review, November, 1918.

ANESTHESTICS, ADMINISTRATION OF, TO SOLDIERS. A. Mills. British Medical Journal, September 28, 1918.

BLOOD CHANGES UNDER GENERAL ANESTHESIA. L. Binet Presse Medicale, September 9, 1918.

CARDIAC STRENGTH, ESTIMATION OF AND IMPORTANCE OF CONSERVING ENERGY DURING AND FOLLOWING OPERATIONS. R. R. Huggins, Pittsburgh. New York State Journal of Medicine, September, 1918.

CHLOROFORM ANALGESIA BY SELF-ADMINISTRATION AS ADAPTED FOR DRESSING WOUNDS. Torald Sollman, Cleveland, O. Journal American Medical Association, August 24, 1918.

CHLOROFORM, FATAL SYNCOPE UNDER. J. De Moraes. Amazonas Medico. March, 1918.

DEATH, SUDDEN, AFTER AN ANESTHETIC IN LATENT CASE OF SHELL GAS POISONING. P. Turner, London. Lancet, September 21, 1918.

ETHER, FEW DIFFICULTIES IN THE ADMINISTRATION OF. D. E. Hoag, Pueblo. Colorado Medicine, September, 1918.

ETHERIZATION, PRACTICAL POINTS IN. T. H. Becker, Bluefield. West Virginia Medical Journal, August, 1918.

EXODONITA-ANESTHESIA FOR. B. A. Batson, New Hebron, Miss. Dental Cosmos, November, 1918.

HEART LESIONS IN ANESTHESIA. F. L. Richardson. Boston Medical and Surgical Journal, October 10, 1918.

INTRATRACHEAL GENERAL ANESTHESIA. Guisez. Presse Medicale, August 29, 1918.

LOCAL ANESTHESIA-APOTHESINE AND EPINEPHRIN IN REMOVAL OF TONSILS. J. Coleman, New York City. Medical Record, September 7, 1918.

LOCAL ANESTHESIA, CESEREAN SECTION UNDER. Wm. M. Brown, Rochester, N. Y. Transactions American Association of Obstetricians and Gynecoloists, 1918.

LOCAL ANESTHESIA FOR CESAREAN SECTION. H. H. Trout, Roanoke, Va. Surgery, Gynecology & Obstetrics, July, 1918.

LOCAL ANESTHESIA, BRACHIAL PLEXUS, PNEUMOTHORAX FROM INJURY, WHILE USING. A. Vischer. Correspondenz-Blatt für Schweizer Aerzte, June 8, 1918.

LOCAL ANESTHESIA, COCAIN, IN ABDOMINAL SURGERY. A. E. Marulande. Repertorio de Medicina y Cirurgia, July, 1918.

LOCAL ANESTHESIA AND ELECTRICAL CAUTERY DRAINAGE OF ABSCESS OF THE LUNG. A. D. Bevan, Chicago. Surgical Clinics of Chicago, October, 1918.

LOCAL ANESTHESIA FOR THE EYE AND ORBIT. Duverger. Presse Medicale, August 5, 1918.

LOCAL ANESTHESIA, RADICAL CURE OF HERNIA UNDER: COMBINED WITH SCOPOLAMIN AND MORPHIN. J. H. Cunningham, Jr. Boston Medical & Surgical Journal, September 5, 1918.

LOCAL ANESTHESIA—LATE PERFORATION OF TYPHOID ULCER: LAPAROTOMY UNDER NOVOCAIN ANESTHESIA: RECOVERY. H. C. Cooney, Princeton, Minn. Surgery, Gynecology & Obstetrics, October, 1918.

LOCAL ANESTHESIA-LAMINECTOMY UNDER REGIONAL ANESTHESIA. C. H. Frazier, Philadelphia. Annals of Surgery, July, 1918.

LOCAL ANESTHESIA FOR RECTAL SURGERY. R. E. Farr, Minneapolis. Medicine & Surgery, May, 1918.

LOCAL ANESTHESIA, SCOPE OF. Thos. O. Burger, San Diego, Cal. Medicine & Surgery, May, 1918.

LOCAL ANESTHESIA—TECHNIC OF PERINEURAL ANESTHESIA FOR RADICAL SURGERY OF MAXILLARY SINUS. L. Gatewood, New York City. Laryngoscope, August, 1918.

LOCAL ANESTHESIA, TONSILLECTOMY WITH. P. V. Mikell, Columbia. South Carolina Medical Association Journal, August, 1918.

LOCAL ANESTHESIA, SYMPHYSIOTOTOMY UNDER. Y. de Reynier. Correspondenz-Blatt fur Schweizer Aerzte, August 24, 1918.

LOCAL ANESTHESIA—PARAVERTEBRAL ANESTHESIAS TWO-STAGE OPERATION FOR CARCINOMA OF THE UTERUS UNDER. N. R. Mason and F. C. W. Conrad, Boston. Surgery, Gynecology & Obstetrics, July, 1918.

LOCAL ANESTHESIA FOR THYROIDECTOMY. Carrol W. Allen, New Orleans Medical & Surgical Journal, November, 1918.

LOCAL ANESTHESIA, PROCAIN FOR DENTAL OPERATIONS. Stephen P. Mallett, Boston, Mass. Dental Cosmos, November, 1918.

NITROUS OXID ANESTHESIA. J. Lopez. Repertorio de Medicina y Cirurgia, Bogota, March, 1918.

NITROUS OXID-OXYGEN ANESTHESIA, EXTRACTIONS UNDER. B. Vend, New York City. Dental Outlook, October, 1918.

SCOPOLAMIN-MORPHIN AMNESIA IN LABOR. W. R. Livingston, Oxnard, Cal. American Journal of Obstetrics, October, 1918.

SHOCK, SURGICAL, FURTHER EXPERIMENTAL STUDY OF. F. C. Mann, Rochester, Minn. Journal American Medical Association, October 12, 1918.

SPINAL ANALYSIS IN GYNECOLOGY, ROUTINE USE OF. N. M. Bey. Lancet, August 3, 1918.

SPINAL GENERAL ANESTHESIA BY COCANIZATION. G. le Filliatre. Paris Medical, June 15, 1918.

SPINAL ANESTHESIA IN GENITO-URINARY SURGERY. G. G. Smith and Freeman Allen, Boston, Mass. Urologic & Cutaneous Review, November, 1918.

SPINAL ANESTHESIA IN UROLOGY. W. B. Dakin, Los Angeles, Cal. Urologic & Cutaneous Review, November, 1918.

STOVAIN, DIFFERENTIAL REACTIONS OF. J. A. Sanchez. Semena Medica, May 9, 1918.

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April, 1919

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COTTON PROCESS ETHER AND ETHER ANALGESIA.*

JAMES H. COTTON, M.A., M.D.
TORONTO, CANADA.

Only a few years ago it was customary for the anesthetist to classify an ether as good or bad, according to its irritative properties. These were roughly estimated by the annoyance caused the anesthetist by the hypersecretion of mucous and little attention was paid to the amount of ether used or the concentration of its vapor. If a patient did not respond as rapidly as expected to etherization, he was considered an alcoholic or to be otherwise immune to its effects. Some few anesthetists realized that *too closed methods* of administration (Clover inhaler) produced the excessive secretion of mucous, while others improved their results by making the concentration of their ether vapor as uniform and low as was consistent with good, surgical anesthesia.

To establish a clear line of research a series of analyses and administrations were undertaken to determine the actual role of the irritative properties of ether impurities. These were divided into (a) *anterior nasal,* due to alcohol or acetones; or (b) *nasopharyngeal,* due to aldehydes. *Smells,* for the most part, were found to be due to the sulphur group.

It was found that the actual irritation value of any ether of standard aldehyde percentage to the mucous membrane, varied inversely with the anesthetic power of the said ether, and directly with the immunity of the patient to ether anesthesia. This presupposed that (1) patients varied; as also do (2) the anesthetic powers of different cans of ether.

In proof of the first contention a large amount of ether was mixed and administered to different groups of patients. Five cases of a known alcoholic type were compared with five cases, of a similar weight, but of a type which had not indulged. These patients were from 30 to 35 years of age. The alcoholics required from 25 to 75 per cent. more ether than did the non-alcoholics. Although the variation is not exact, the age and weights propositions were considered as having already been sufficiently proved.

In discussing the variation in anesthetic potency of different cans of ether, an unlimited field of research is entered, that leads back to the startling suggestion of a year ago that: *"absolute ether is not an anesthetic at all."*

*Read during the Joint Session of the Interstate Association of Anesthetists and Indiana State Medical Association, Claypool Hotel, Indianapolis, Ind., September 25-27, 1918.

ANESTHESIA.

Before proceeding further it is necessary to come to an agreement concerning the state commonly considered as anesthesia. Personally, *I consider anesthesia as analgesia—blocking of sensory impulses from the periphery, plus narcosis—or sleep.*

When a patient shows a type of breathing, a certain amount of muscular relaxation and contracted central pupil, is he actually surgically anesthetized? For years anesthetists and surgeons have recognized ether anestheisa by a series of such symptoms, and have neglected the fact that patients carried to this stage may still suffer from severe shock, and instead of being anesthetized are in reality only narcotized.

Interpreting each nervous system by the symptoms which customarily arise from it, what results obtain when a pure nerve poison acts upon the nervous system complex? Some well recognized facts are: (1) that a nerve poison acting on any nervous system first stimulates, then depresses, then kills; (2) that the more specialized a nervous system, the more sensitive it will be and the more easily it is stimulated, depressed and killed; and (3) that the order of specialization of the various nervous systems are:

Most specialized:

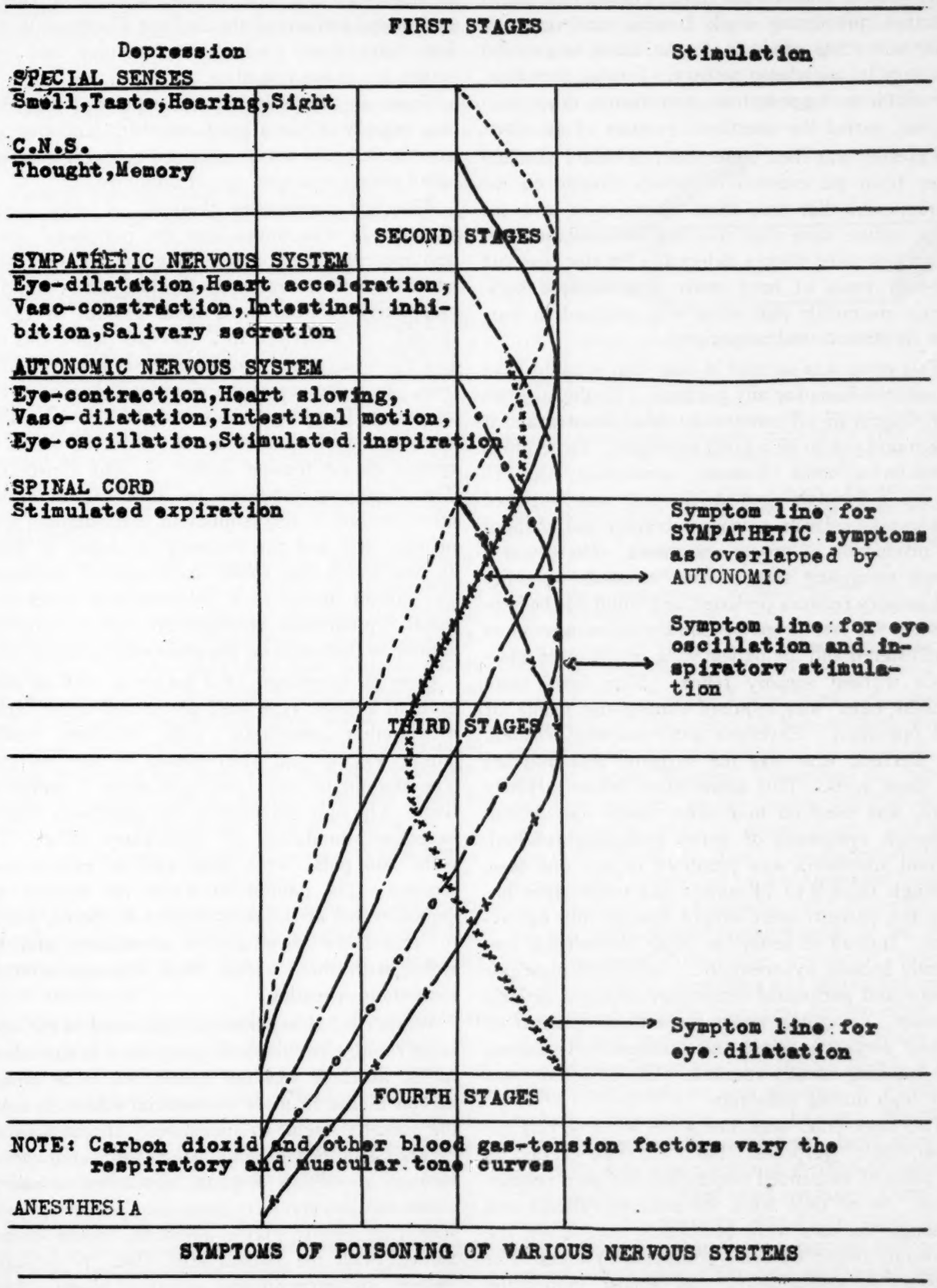
Special Senses,
Central Nervous System,
Sympathetic Nervous System.
Autonomic Nervous System,
Spinal Cord.

Least Specialized:

Now all these stages and symptoms of nerve cell poisoning are those of anesthesia as quoted in the text-books, but not of real anesthesia since they do not in any way fulfill the requirements for the blocking of sensory nerve impulses, and the very basis of the teaching of anesthesia, apparently has been incorrect. Anesthetists and surgeons have been safeguarding the toxicity of ether and neglecting the shock of operation under narcosis, as nerve cell poisoning is simply an additive factor to operative shock.

ANESTHETIC POWER AND VARIATIONS FOUND IN MARKETED ANESTHETIC ETHERS.

Three years ago statistics affecting 150 abdominal cases operated under anesthesia by a certain brand of ether were compared with the results in another 150 similar cases, anesthetized with another make of ether. With one ether, after induction, from 4


FIRST STAGES
Depression
Stimulation
SPECIAL SENSES
Smell, Taste, Hearing, Sight
C.N.S.
Thought, Memory
SECOND STAGES
SYMPATHETIC NERVOUS SYSTEM
Eye-dilatation, Heart acceleration, Vaso-constriction, Intestinal inhibition, Salivary secretion
AUTONOMIC NERVOUS SYSTEM
Eye-contraction, Heart slowing, Vaso-dilatation, Intestinal motion, Eye-oscillation, Stimulated inspiration
SPINAL CORD
Stimulated expiration
Symptom line for SYMPATHETIC symptoms as overlapped by AUTONOMIC
Symptom line for eye oscillation and inspiratory stimulation
THIRD STAGES
Symptom line for eye dilatation
FOURTH STAGES
NOTE: Carbon dioxid and other blood gas-tension factors vary the respiratory and muscular tone curves
ANESTHESIA

SYMPTOMS OF POISONING OF VARIOUS NERVOUS SYSTEMS

to 8 ounces were required per hour of maintenance; with the other ether from 6 to 12 ounces. From the aldehyde research it had appeared likely, but this was the first actual record that anesthetic ethers could vary in potency. It was found that the more potent ether contained traces of gases as well as more alcohol. Clinical trial of the weaker ether, in some ten cases. by increasing the alcoholic con-

tent, while it lowered the freezing point of exhaled moisture, preventing mask frosting and retaining ether and ether products on the mask longer, did not vary its anesthetic potency. It was, therefore, reasonable to suppose that some factor, other than alcohol, varied the anesthetic potency of an ether.

Research was then undertaken to obtain absolute ether from the commercial ethers already on the market. At that time these ethers were in a far more impure state than they are now, as the fusel oil groups were always detectable. After one and one-half years of hard study and work, a sufficiently chemically pure ether was obtained to warrant its clinical trial on patients.

This ether was so mild in odor that it could have formed the basis for any perfume. To the surprise and chagrin of all concerned, on administration, it was found not to be a good anesthetic. Dr. Samuel Johnston, a noted Toronto anesthetist, used 15 ounces on a middle-aged patient, who was congested to blueness without mucous secretion and without the production of proper anesthesia. There was a severe struggling stage; while muscular rigidity and sensory reflexes persisted and could not be suppressed. A few drops of Squibbs ether were then administered and the patient sank into a quiet anesthesia without sensory reflex. Very little more Squibbs ether was required during the whole of that operation. Excessive after-sickness resulted. Dr. Perfect, who was the surgeon, also vouches for these facts. This same ether, *when perfectly fresh,* was used on nine other cases,—all dental. Although symptoms of nerve poisoning resulted, no real anesthesia was produced in any one case, although from 9 to 14 ounces had to be given before the patients were stupid enough for extractions. Instead of sensation being obtunded it frequently became hyperesthetic. Persistent muscular tremor and peripheral congestion occurred in each instance. On going under patients complained of *feeling perfectly awful* and postanesthetic nausea and vomiting usually resulted. The pulse-rate rose very high during induction.

This same ether was then given to three cats for experimental purposes. Each cat was carried to the point of suspended respiration and then resuscitated. At no time were the muscles relaxed and although the cats were completely narcotized, the leg would twitch on being pricked with a pin. The recovery on resuscitation was almost immediate. After being supposedly killed three times, an apparent anesthetic condition could be obtained, but this was probably due to exhaustion. A few months ago this experiment was repeated in detail before a number of interested witnesses at one of the experimental stations of the DuPont Chemical Works, but since then similar results have not been found by these chemists.

From the above data it was concluded that absolute ether was not a good anesthetic and that real anesthesia could not be obtained unless it contained some potent synergist as yet unknown.

The first cooperative thought of was carbon dioxid. It was found that the peripheral spasm and muscular tremor following the administration of from 6 to 8 ounces of absolute ether, could be completely relieved by a small amount of carbon dioxid. As described in a previous paper, this *carbon dioxid-absolute ether anesthesia* is a type of its own. In a demonstration given at the Academy of Medicine, Toronto, I compared the action of absolute ether with that of nitrous oxid, in which the carbon dioxid tension factor is also a necessity. The anesthesia produced by this carbon dioxid-ether method is very similar to that obtained from nitrous oxid and the recovery is almost as rapid. In practice, it was found convenient to administer the carbon dioxid in a solution with ether in a metal syphon-soda arrangement with a controller similar to that used on the glass ethyl chlorid tubes.

Over 20 operations of a major as well as many cases of a minor type were performed under carbon dioxid-ether anesthesia with excellent results. There was no real after-nausea in any one case. The amount of ether averaged about 5 ounces an hour. The only objection to the anesthesia was the excessive stimulation of respiratory effort. The color and pulse were good and no case showed mucous. The patient on whom the method was demonstrated at the Academy of Medicine, Toronto, joined the physicians in attendance, and had coffee with them within three minutes after his extraction operation.

While clinical experiments continued in the operating room, ether research progressed in the laboratories, as there was not considered to be enough carbon dioxid in most commercial ethers to act as the potential factor in anesthesia. *It was then discovered that this absolute ether on being passed through a certain process, developed wonderful anesthetic powers.* Its analgesic properties were such that almost major operations could be performed with the patient still able to articulate clearly, without pain and not at all sleepy. More concentrated administration produced beautiful, quiet, sleep anesthesia, without shock. After a certain length of time, however, this product would deteriorate to an unusable degree, although the

analgesic power increased in more than equal proportions. A few breaths, although fairly irritating, would produce almost completely obtunded sensation for some hours. Six cases were tried, including myself and friends, and we began to wonder if we were ever going to completely recover our feelings. We were otherwise normal, except for a slight sluggishness of memory.

Careful concentration and extraction of gases from this product demonstrated the presence of certain ethylenes and their by-products. As these were not present in the absolute ether base, they must have developed in the process.

Ethylene gas was then made by text book methods and added to absolute ether. It transformed absolute ether into a moderately good anesthetic, but the results were not comparable with those previously obtained; in fact such ether was by no means as good as Squibbs'. However, with careful synthesizing and research, anesthetic synergists of exceedingly high value and potency were finally obtained.

The product, now recognized by the medical profession as Cotton-Process Ether, is simply ether, purified to an almost absolute stage by the methods originated, plus these synergists. As these synergists were for the most part of a gaseous nature it was considered desirable to retain them in the ether in greater quantities than would remain at ordinary atmospheric pressure. With this end in view the ether has been kept in sealed glass ampules of about 1 ounce capacity, the idea being to administer it direct from such containers.

PECULIARITIES OF COTTON-PROCESS ETHER FOR ANESTHESIA.

Although this ether was primarily developed for analgesia only, a number of anesthetists and surgeons have used it and have reported it satisfactory for anesthesia.

Method 1—Administration from Drop Bottle on Open Mask. This method, though apparently successful, should never be used, as ether gases of great anesthetic value are allowed to escape. By this method the anesthetic power is about that customarily obtained from any good commercial ether, the after-effects being possibly less.

Case 1. Patient, female; age 28; weight 160 lbs.; operation for intestinal adhesions; induction gas-ether; time 4 to 6 minutes; time of operation 1 hour. Amount of ether used 8 ounces by volume on open mask. Condidition during operation: absolute relaxation; no mucous; color and pulse normal.

Method 2—Administration Direct from Ampule on Open Mask. The glass tip of the ampule is broken off and the end of the ampule is inserted into the rubber socket of a device similar to the automatic cut-offs of ethyl chlorid tubes. The gas pressure in the ampule is sufficient to expel the ether when the cut-off is opened and the ether is dropped or sprayed on the mask as with ethyl chlorid.

DEVICE FOR ATTACHING TO ETHER AMPULE.

Case 1. Patient, female; age 41; weight 104 lbs.; pulse 120; operation thyroidectomy. Previous medication ⅛ gr. morphin and 1/200 gr. atropin 20 minutes before anesthesia. Administration: pulse immediately after induction was 110. During the operation it dropped to 100, then to 80. On recovery it registered 108. Time of induction 3 minutes; time of operation 1 hour. Patient recovered sufficiently to speak in 20 minutes. Was somewhat drowsy for several hours. Amount of ether used 5 ounces. No after nausea. Surgeons: Drs. Perfect and Harrison.

Case 2. Patient, Mrs. C.; age 70; weight 112 lbs.; operation, breast amputation. Administration: time of induction 6 minutes; operation 1 hour. Amount of ether used 5.5 ounces. No after nausea and patient recovered before reaching room. Stated she had enjoyed going under. Surgeons: Drs. Hay and Wesley.

Method 3—Oxygen Semi-Closed. A. Gwathmey Apparatus. The value of this method was first drawn to the author's attention by Dr. J. F. Baldwin of Grant Hospital, Columbus, O., who was the first surgeon to use highly charged ether in any moderate series of major cases. The technic is one of Dr. R. A. Rice's "Perfected Methods of Anesthesia" (described in the American Year-Book of Anesthesia & Analgesia, 1915-1916) in which oxygen, from a low pressure tank, is led through the Gwathmey three-bottle, dosimetric vapor apparatus, with its ascending and descending percentage control, and the saturated oxygen-ether vapor, washed and moistened in the warm water bottle, is conducted by means of a rubber tube to a closely fitting face mask, or oral air-way, to which is attached a rebreathing bag. Baldwin reported 20 abdominal operations carried out, from start to finish, with this apparatus and method of anesthesia. The amount of ether used averaged from 1 to 3 ounces. The recovery was more rapid and the after-effects less than those occurring with ordinary ether. With this ether and method it was possible to induce anesthesia by the vapor method, whereas, previously, with other tinned ether, ethyl chlorid was always used for induction and almost

double the amount of ether was found necessary for maintenance.

B—Modified Vapor Apparatus. This apparatus was designed to provide a vapor device with a large ether container, providing area sufficient for surface evaporation, thus obviating the undesirable feature of carrying over ether particles, as they are bound to be when the oxygen is passed through the ether. The ether is placed in the container (E)

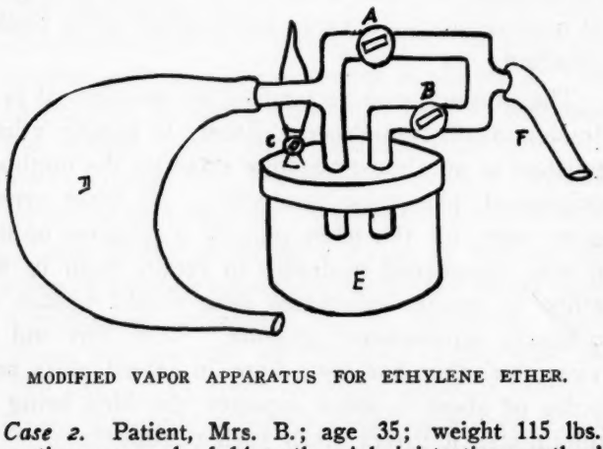
RICE PERFECTED METHOD FOR VAPOR ETHERIZATION.

through a tap in the top of the container, all ether gasses being thereby retained. Oxygen is admitted from a low pressure tank into (D) a soft rubber bag at the rate of about 10 litres an hour. With the mask fitted tightly over the patient's face, tap (A) is opened, permitting the breathing of oxygen, then tap (B) is slowly opened, allowing part of the oxygen to carry over ether vapor. As more ether is required tap (A) is closed down. Excess rebreathing, causing dysphonia, may be rectified by emptying bag (D). The whole apparatus is hung on the oxygen tank.

This method is positively fool-proof for Cotton Process ether and will maintain the patients uniformly at any required depth of anesthesia. With it the new ether shows over double the anesthetic potency of tinned ether and recovery is almost instantaneous.

C—Perfected Apparatus. This is described under the consideration of analgesia and was developed to provide a simple, portable device, especially available for war purposes.

Case 1. Patient, Nurse; age 28; weight 125 lbs.; operation removal of tonsils. Administration: author's special apparatus. Time for induction 4 minutes; complete surgical anesthesia apparently obtained. Time for removing first tonsil 2 minutes; patient then completely awake but without feeling. She carried on conversation for 3 minutes when mask was reapplied; anesthesia reinduced in 1 minute. The same rapid recovery after removal of second tonsil. Soreness in throat was not detectable for over one-half hour and during this period patient took nourishment. She considered the whole procedure a very pleasant experience. Amount of ether used 1.5 ounces. Throat reflex present before each tonsil was completely removed. Surgeon: Dr. Perfect. Witnesses: Drs. H. Harrison and Carveth.



MODIFIED VAPOR APPARATUS FOR ETHYLENE ETHER.

Case 2. Patient, Mrs. B.; age 35; weight 115 lbs.; operation, removal of 14 teeth. Administration: author's apparatus, patient in sitting posture. Time of induction 4 minutes. Patient held her own mouth open. Did not complain of pain for 10 minutes. Anesthesia was reinduced in 2 minutes and the remaining teeth removed. Patient was quite awake all the time and was able to walk about afterwards. Amount of ether used 1.5 ounces. Surgeon: Dentist. Witnesses: Drs. Carveth, Perfect and Harrison.

Report from Mrs. B.: Arrived home about 1:30 P. M. feeling pretty good considering, so much so that I walked home rather than get in and out of street car. Had a cup of tea and soaked biscuit and laid down. When taking the ether I did not have any going away sort of feelings and was not at all nauseated. I can remember coming round partly before the dentist finished, but it caused me no pain. I could have eaten hot roast pork had there been any and my mouth permitted.

(Signed) LILLIE BOOTH.

Case 3. Patient, female; age 35; weight 115 lbs.; operation, cholecystectomy and appendectomy. Administration: author's apparatus. Time of induction 5 minutes. Previous pulse 100; pulse during operation 70. Relaxation during first part of operation easily obtained. Duration of operation 1 hour and 20 minutes. Amount of ether used 3.5 ounces. Regurgitated 4 ounces, but did not remember it or suffer from after nausea. Patient was able to walk while being returned from the operating-room. Surgeons: Drs. Perfect and Harrison.

Personally I have found that by open methods, although the amount of ether required is not large, patients recover so rapidly from deep stages of anesthesia that a careful and even drop-rate administration is required. By the oxygen semi-closed vapor apparatus the maintenance of anesthesia is much more regular. If anesthesia is badly administered, however, a certain amount of salivation may result. The Carveths of Toronto consider the new ether ideal as an induction anesthetic, for it is very rapid, and out of a fair number of cases they have not yet noted any excitement stage. They maintain anesthesia by any method whatever, except in abdominal work. Here, they state that the patient's muscles cannot always be completely relaxed, although there is never any muscular spasm. This opinion has been corroborated by some other anesthetists and therefore deserves consideration.

POSTOPERATIVE NAUSEA AND VOMITING.

For years, postoperative nausea and vomiting have been recognized as the great disadvantages of etherization. In a previous paper it was shown that carbon monoxid may be produced by the superheating of ether in contact with metal and the slightest trace of this poison, when present in ether, will cause severe nausea. It is frequently introduced into ether by the high temperature from soldering the can. *It must also be remembered that if an ether is not a sufficiently potent anesthetic, due to the absence of its synergists, a very large amount of the ether or narcotic group will have to be administered, and postnarcotic nausea and vomiting must follow.*

With ethylene-ether nausea and vomiting after patients have awakened has not yet occurred, as far as the author has been able to secure information, but regurgitation before awakening has taken place in the use of oxygen semi-closed methods of etherization when the administration was stopped too abruptly.

In selecting patients for this anesthetic attention should always be paid to the urinary analysis in order to detect the presence of any degree of acidosis. In judging the sickening effects of any anesthetic it is well to bear in mind the following two facts: (1) Postoperative nausea rarely occurs in elderly people, especially when they are suffering from any degree of heightened blood-pressure; and (2) a certain class of operations having to do with the intestines and especially the gall-bladder, will, of themselves, give rise to nausea and vomiting.

ANALGESIA.

This whole research was undertaken to develop some reliable method of producing analgesia, especially for the handling of war wounds, and during its course the following data were secured for study:

Exhibit A—Comparison of Induction Analgesia with Absolute and Ethylene Ethers: Oxygen Semi-Closed Method. Absolute ether was first administered to 12 cases and the results studied relative to blood-pressure, pulse-rate, analgesia and after-effects. Two days later a similar series of administrations were undertaken on the same cases with absolute ether containing a large amount of ethylene derivatives.

With the absolute ether the blood-pressure immediately rose 16 to 20 mm., systolic, whereas when ethylene was present, in half the instances it dropped 10 mm., in three it remained normal and in the remainder it rose 10 mm. With absolute ether analgesia resulted in six cases, while the other six patients became hypersensitive and remained so until they fell asleep. *The period of analgesia occurred in all cases in which ethylene ether was administered, long before the patients became unconscious.*

Patients inhaling absolute ether complained of a very depressing sensation during the induction and most of them went into a struggling stage, at which point the administration of the anesthetic was stopped. Their recovery was exceedingly slow and violent headaches invariably occurred within an hour. Those patients taking the ethylene-ether enjoyed going under; there was no excitement or struggling stage; recovery was almost instantaneous and none complained of unpleasant after-effects.

Exhibit B—Rebreathing of Oxygen. As methods involving the rebreathing of oxygen had been found useful for the administration of ethylene-ether, it was thought desirable to study them more closely. Vapor-apparatus similar to that described under Anesthesia was used. The ether container was filled with caustic potash sticks in order to absorb any accummulation of carbon dioxid. An excess of oxygen was given,—10 to 20 litres per hour, and the blood-pressure readings were closely followed in 20 cases. Eighteen of these showed a slight drop in systolic and a fair rise in diastolic pressure. The other two had their rise in diastolic, but their systolic pressure did not vary. The pulse-rate remained normal in all cases.

Exhibit C—Blood-Pressure Variations. The figures in Chart I are the average of those recorded

with a commercial ether containing very little ethylene and those in Chart II with an ethylene-saturated ether, respectively.

BLOOD-PRESSURE VARIATIONS: CHART I.

Time	Pressures Systolic	Diastolic	Pulse	Pulse Rate	
Previous	120	80	40	80	
1	150	70	80	116	
2	160	72	88	96	
3	160	90	70	80	Beginning Analgesia:
4	130	100	30	80	not Surgical
5	135	110	25	80	
5.5	145	118	32	80	
6	150	118	27	80	
6.5	140	90	50	80	
7	130	85	45	90	No Analgesia
7.5	128	90	38	100	
8	120	85	35	110	
8.5	118	100	18	100	
9	115	105	10	90	Struggling Stage
9.5	110	85	35	90	

BLOOD-PRESSURE VARIATIONS CHART II.

An ethylene saturated ether.

Time	Pressures Systolic	Diastolic	Pulse	Pulse Rate	
Previous	120	75	40	80	
1	130	90	40	90	
1.5	140	100	40	100	
2	140	105	35	80	Analgesia to Surgical
3	140	100	40	80	Degree
4	120	90	30	72	Sleep
80 mins.	120	90	30	72	Anesthetic stopped
85 mins.	130	90	40	85	

From these figures it is readily seen that the ethylene group acts as a stabilizer of the circulation. Relative to the struggling stage it was observed that this complication always seems to occur when the pulse-pressure was extremely reduced by a decrease of systolic as well as a rise in diastolic blood-pressure. Patients, sufficiently conscious at this stage, blamed their restlessness on a peculiar numbness,—not analgesia, as well as a hollow sensation in the abdomen. With the onset of sleep there always occurred a drop of about equal degree in both the systolic and diastolic pressure. Whether this drop is responsible for sleep is a question that can only be satisfied by circumstantial evidence.

THEORY OF ANALGESIA.

Bearing in mind the data developed in *Exhibits A, B and C,* it is of interest to study the various physico-chemical changes of *state of solution* and *vapor tension* of ether as it passes through the blood stream, with the view of determining how ethylene synergists may act in producing analgesia.

The boiling point of absolute ether is about 34.5° C. When ether is administered it passes through the walls of the alveoli to enter into solution in the blood circulating in the lung tissues. The temperature of this blood is between 36° and 37° C., or 1.5° to 2.5° C. above the boiling point of ether. On this account an ether-gas-tension will develop, thereby limiting the amount of ether that can enter the blood stream.

The point of maximum heat production in the circulation is in the end capillaries of the peripheral tissues where combustion takes place. Here the temperature suddenly rises to over 39° C. It will be easily understood, therefore, that when the ether from the lung tissue reaches this point through the arteries, the gas tension will be enormously increased, both on account of the lowering of pressure and the increasing of temperature.

Ether, like alcohol, acts centrally and otherwise on the nervous system to cause a general vasodilatation, thereby slowing the blood stream in the capillaries and reducing the metabolism and temperature. This is shown by the drop in diastolic pressure taking place on the administration of absolute ether.

Volatile anesthetic substances enter the blood stream at the lung capillaries much more slowly than does ether. If they are present in the ether administered, the vasodilatation caused by the ether will be replaced by vasoconstriction as soon as they gather in the peripheral circulation in sufficient concentration. That is, the administration of an ether together with these anesthetic gasses, is followed by a short period of vasodilatation, succeeded by vasoconstriction and increased capillary combustion. During this vasodilatation the heart will beat more rapidly due to the relief of pressure, but as soon as vasoconstriction develops, the pulse slows down with the increasing resistance.

It has already been emphasized that when ether only is present in the blood stream there is an ether-gas-tension increasing in the peripheral tissues, which is lessened according to the resulting vasodilatation, by the reduction in metabolism as well as the relative approximation of blood-pressure between arteries and capillaries. Thus it can be seen that when the ether-gas-tension in the capillaries becomes very great and these capillaries are constricted, there will be an enormous escape into and retention of ether in the surrounding tissue fluids, and the ether becomes concentrated in the lymph and tissue cells. When this concentration is sufficient the sensory nerve endings lying in the tissue fluid will become insulated and no longer able to function. The motor nerve endings are not affected as they enter directly into the cells that they govern.

In the central nervous system, where the metabolism is not nearly so great, the ether will not localize. In other words, if the capillaries throughout the body are kept normally constricted, ether will localize in tissues according to their state of metabolic activity and this localization produces

localized analgesia by sensory nerve ending insulation. The blood-pressure curves, already charted, show that ethylene and carbon dioxid (as we have already assumed), tend to equalize the circulation by lowering the systolic as well as raising the diastolic pressure. Oxygen, as has been shown, does practically the same thing, to a much less extent, and therefore might also be classified as a synergistic gas.

It must be remembered in this connection that volatile anesthetic substances cannot maintain constriction of capillaries unless the nerve control of these capillaries is healthy; and without this maintenance marked analgesia is impossible. Bearing on this point is the fact that it is exceedingly difficult to obtain analgesia (without narcosis) in patients suffering from anemia, hemorrhage, syphilis and prolonged fever.

METHODS FOR OBTAINING ANALGESIA WITH ETHYLENE-ETHER.

These methods aim to utilize all the gasses in ether, as the analgesic power of an ether depends on their presence.

Method A—Open Mask Administration direct from Ampule. An arrangement such as described under *Method 2* in Anesthesia was found convenient.

ILLUSTRATIVE CASES.

Case 1. Female; weight 180 lbs.; age 42; operation, breast amputation; time of operation, 45 minutes; anesthetist, Dr. Carveth. Patient capable of talking throughout whole of operation. She had no pain whatever and could not feel on what part of the body they were working. Ether used, 5 ounces.

Case 2. Male; Base Hospital, Toronto; weight 150 lbs.; age 48; operation, resection and cauterization of part of abdomen for cancer; time of operation, 1 hour. Patient capable of talking throughout and quite clear mentally. He complained of being hungry before the hour was up. Pain returned within 3 minutes of cessation of anesthetic. Ether used, 3 ounces.

Case 3. Male; age 18; weight 180 lbs.; operation, adhesions and resection of tubercular mass from abdomen. Time of operation, 1 hour and 10 minutes. Patient remained very clear mentally and cracked jokes throughout. He was given a small meal while the surgeons were operating on him. Abdomen was completely relaxed, except at one time when he insisted upon kissing the nurse. Eyes were slightly dilated and pulse remained at 80. Amount of ether used, 3 ounces.

Case 4. Male; aged 48; weight 132 lbs.; operation, opening and scraping abscess. Time for induction, 5 minutes. Senses dulled and unable to talk clearly. Length of operation, 12 minutes. Amount of ether administered, 2 ounces. Patient held his breath for one-half minute during recovery, which was complete in one minute. Patient then changed tables himself. There were no after-effects. Surgeon: Dr. Harrison. Witness: Dr. Carveth.

Case 5. Male; aged 33; weight 190 lbs.; returned soldier; operation, opening arm. Patient complained of feeling dull, but otherwise felt normal. Time of operation, 45 minutes. Time of induction to analgesia, 6 minutes. While under he stated he did not simply want to lose sensation to pain but that he wished to go to sleep, as he was tired. Amount of ether used, 3½ ounces. At two previous operations it was impossible to induce him with commercial ethers and chloroform had to be resorted to.

Case 6. Male; aged 42; weight 140 lbs.; operation, resection of teeth from ankylosed jaw. Time of induction, 4 minutes. Time of operation, 1 hour and 40 minutes. Amount of ether used, 6 ounces. Patient sat up and held his head in position while teeth were resected from jaw. He had no sensation whatever to pain. He answered the phone twice during the operation and seemed to be in possession of all his mentality.

Case 7. Comparison of Cotton Process Ether with ordinary C-E Mixture. Patient, aged 24, on account of a recent attack of pneumonia, was to be operated on under local anesthesia for an acute appendiceal condition. She was given ¼ gr. morphin and 1/200 gr. atropin as a preliminary, as she was exceedingly nervous. At 11 P. M. she entered the operating room and the skin over the site of the operation was carefully infiltrated with 0.1 per cent. anocain solution. Six minutes later the incision was made, but the patient was unable to stand further manipulation on account of the deep soreness of the underlying abscess. At the request of the surgeon the houseman started the administration of the C-E Mixture. The patient became excited, and after 1½ ounces had been used she dropped into a light sleep, but the abdominal muscles were extremely rigid and there was a tendency to stop breathing. The incision made through the anterior aponeurosis was followed by severe muscular spasm. I then suggested the use of an ampule of ethylene-ether on the open mask. The patient was allowed to wake up and the ethylene-ether was then given on the open mask, without the usual surrounding towel. Within four respirations her muscles relaxed completely and she was entirely without sensation, although she was able to answer questions clearly and was not excited, and would do anything requested. The operation continued and the abdomen was opened. The appendix had not ruptured, but the whole of the cecum was adherent to the abdominal wall and pelvis. One ounce of ethylene-ether had been used by this time and as another ampule had to be fetched from the storeroom, the C-E Mixture was again administered to note its effect. Sensation returned and the patient became blue if the C-E Mixture was pushed. Ethylene-ether was again used. The patient woke up and was able to talk. Her abdomen again relaxed. Operation continued for one hour. Adhesions were broken down and the appendix successfully removed. Three ounces of ethylene-ether was used. During its use, at any time during the operation, the patient could have walked as easily as she talked. Afterwards she remembered answering questions but did not know anything about the operation while under the ethylene-ether.

One peculiar fact was noted. While under ethylene-ether the pulse ranged about 80 and under the C-E Mixture it would immediately rise to 120. The patient stated that she was hungry and thirsty during the operation, as she was also afterwards. There was slight dilatation of the pupils, but otherwise they were normal. They would roam about when covered, but fixed on any object when allowed to see.

Patient was as clear mentally at the end of the operation as at the beginning. Pain recurred within 3 minutes after cessation of the anesthetic.

Other Cases.

15 Obstetricals: These patients were entirely relieved from pain, without reduction of the expulsive effort. Six were primiparae and in four forceps had to be resorted to. One case was an induced delivery of a dead fetus at 8 months, while in another instance operative measures were required on account of hydrocephalus.
59 Cases of successful Analgesia reported by Dr. Hudson.
9 Dental cases reported by Dr. Carveth.
32 Dental cases reported by the Dental Department of the Toronto General Hospital.
6 Dental cases for relief of pain for drilling.
6 Breast Abscesses.
40 Administrations for Dressings.
1 Epispadias Operation.

2 Hernias.
4 Varicoceles.
4 Abdominal Operations.

B—Bottle Inhaler Method. Two varieties of this apparatus have been perfected. In each a bottle capable of holding at least 4 ounces was used. The cork in the simpler form was perforated by two tubes, one of which opened to the air and the other T'd off to nasal tubes coming from the nose of the patient. Ether was introduced through open tube to the bottle and patient breathed in through the nose and out through the mouth, as required. Valves were later introduced to prevent the patient from breathing back into the ether bottle. In the more complicated variety the same principles were accomplished by a single perforation of the bottle cork by means of sleeve tubes connected with the valve. This method of administration was found quite unsatisfactory in a number of cases, as it was difficult to teach patients how to breathe, and they would constantly forget as their memory became undermined by the ether. It was used successfully in over 100 administrations for painful dressings and in 20 obstetrical cases. In deliveries, however, a number of failures to secure satisfactory analgesia, by this method of administration, have been reported.

WAR ADMINISTRATION.

Open mask administration in war surgery would be out of the question, as the patients are difficult to induce and it is important to conserve every particle of ether on the battlefield. With this end in view the inhaler bottles were at first thought suitable. Dr. Foot, now in service, attended to the origination of the details of these bottles. They proved unsuitable, as too much time had to be consumed in each case teaching the patients how to breathe properly.

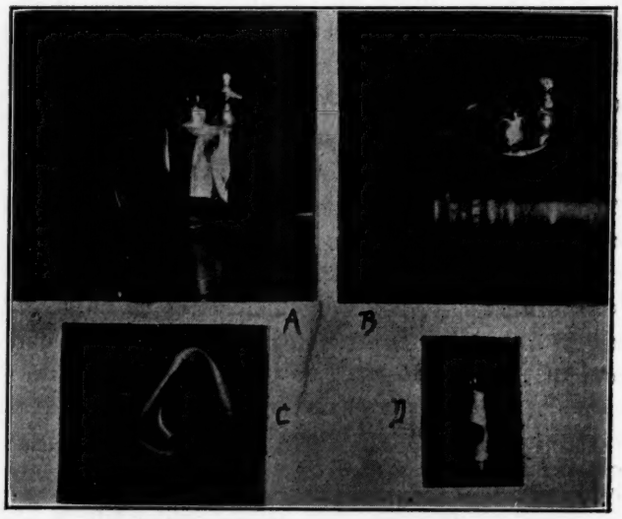
The mask, herewith illustrated, was then conceived and made by the author, and it accomplishes the purpose. With its use analgesia results after four breaths of the anesthetic have been taken and one only depends on the patient to hold the mask in place.

One case lately demonstrated at the Western Hospital was a woman who had been knocked down by a motor car and had her clavicle fractured. She was prejudiced against taking any anesthetic until told that she could give it to herself. The patient talked throughout the whole operation and was entirely without pain until six minutes after the anesthetic was stopped. She then stated that she wanted more of it as it made her happy. There were, of course, no after-effects. Major Harrison of the British Army was in charge of this case. A second case was undertaken with this same apparatus. The patient was 70 years of age and weighed 110 lbs. The operation was to open a knee joint. It required 2½ minutes to induce analgesia. The time of operation was 12 minutes. About one ounce of ether was used and the patient was not at any time abnormal mentally.

For ordinary dressing cases or the probing of wounds, only 1 or 2 cc of ethylene-ether are required when this mask is used. As many as 12 dressing analgesias have been induced with one ounce of this ether.

CIGARETTE INHALATION AND WAR ANESTHESIA.

One very important point with regard to war surgery is that of cigarette inhalation immediately previous to anesthesia by any ether. If the soldier patient has inhaled cigarette smoke within ten minutes of his induction, the systolic blood-pressure will rise from 30 to 100 mm. beyond that rise which would normally take place, and even dilatation of the heart may result. He will also invariably suffer from a headache afterwards. Cigarette inhalation following an anesthetic always aids the recovery of patients from the effects of the ether.



The photos are, for the most part, self-explanatory. Figs. A and B., view the mask from the side, while C. shows the face part. Fig. D. represents the shutter by which the ether is turned off and on. With the handle of the shutter turned toward the nose the patient breathes directly into the bag. The shutter is rotated toward the Intake Tap to turn on the ether. The anesthetic can be poured into the vaporizing chamber by unscrewing the tap or an aliquot can be introduced direct from the ampule by inserting it into the Intake Tap.

For prolonged analgesia or anesthesia oxygen is run into the bag at the rate of from 6 to 12 liters per hour. If the accumulation of carbon dioxid becomes excessive in the bag, and the patient's breathing becomes sterterous, the bag is emptied of its gases and the patient is allowed a few breaths of air. For brief analgesia or anesthesia oxygen is not required and the patient is ordered to fill the bag with one or more big exhalations before the anesthesia is started.

NECESSITY FOR EXPERT ADMINISTRATION.

Many have compained to the author that in order to use this gas-ether they had to learn new and complicated methods of administration, and they did not seem to recognize that this knowledge simply allows them to understand the materials they thought they were so familiar with. In fact, the complaint only goes to emphasize that anesthesia is a specialty requiring the highest possible education in both chemistry and physiology. Unfortunately, certain members of our profession, due most likely to their lack of interest in the subject, have adopted the layman's view that an anesthetist is a mechanical technician, who pours a certain dose of an anesthetic down the neck of his patient. The places of these few might, with profit, be taken by a nurse or trained orderly, as such could certainly not be called anesthetists. They are, at best, assistants to the surgeon. If this view is persisted in it wil not only endanger human life, but further progress in anesthesia will be completely blocked and a blissful ignorance will reign.

A number of nurses, who have witnessed analgesia work with gas-ether for dressing cases, have been delighted, inasmuch as they considered the thing so simple that it represented the beginning of the reign of nursing anesthesia. For light analgesia, such as is required in the dressing of fresh wounds on the battlefield, anesthetist technicians may be able to use this ether and method of administration, when emergency demands, but for major surgery a great deal more knowledge of the intricacies of anesthesia is required for its use than has heretofore been necessary.

This whole research was persisted in for the sole purpose of securing an ether for painful dressings, and if it can be utilized efficiently to make things more bearable for the boys at the Front, our purpose will have been completely accomplished. The theoretical and operative work mentioned in this paper were simply undertaken to this end and the results are given to the profession for what they are worth.

793 SPADINA STREET.

THE AMERICAN ASSOCIATION OF ANESTHETISTS WILL HOLD ITS SEVENTH ANNUAL MEETING IN ATLANTIC CITY JUNE 9-10. AN INTERESTING AND INSTRUCTIVE PROGRAM IS BEING DEVELOPED AND AMONG THE PROMINENT SURGEONS, ANESTHETISTS AND RESEARCH-WORKERS WHO WILL PRESENT PAPERS MAY BE MENTIONED YANDELL HENDERSON, WM. DE B. MACNIDER, JOS. E. LUMBARD, FRANK DYER SANGER, GRIFFITH S. DAVIS, F. L. RICHARDSON, FENTON B. TURCK, ROBT. H. FERGUSON, WM. B. HOWELL, A. W. ADSON, FRANK C. MANN, ALBERT H. MILLER, S. P. REIMANN AND OTHERS. IT WILL REPAY YOU TO ATTEND THIS MEETING.

DEATHS DURING AND FOLLOWING OPERATIONS IN RELATION TO THE SURGEON, ANESTHETIST AND HAZARDOUS RISK.*

E. M. SANDERS, M.D.
NASHVILLE, TENN.

INTRODUCTION:—When death occurs during the administration of a general anesthetic, or immediately thereafter, we are brought face to face with a very trying ordeal; and, as a rule, the attendants are so disconcerted, for the time being, that it is well nigh impossible to get the facts when we come to investigate the matter later.

When we review the history of the early days of anesthesia, we are forcibly impressed by the prompt and painstaking reports of the deaths that were believed to be due to the anesthetic. An investigation of the same subject today is most disappointing, for the reason that we are not reporting a sufficient number of such deaths to make the records instructive and trustworthy; and, when we do report the case, autopsies are the exception and not the rule; and when a postmortem is done and the findings recorded, we usually get a meager previous history and a poor clinical picture of the patient, and very few of the essential facts leading up to the death.

CONCLUSIONS:—After due consideration of the available material, I am able to reach but two conclusions: *First,* that the crusade against chloroform should be vigorously carried on; and *second,* that the administration of gas should be left to the expert. Everything else is more or less unsettled.

For me to come and recommend ether, chloroform, gas, or any other one agent as the ideal drug, or any method of administration as the best, or any combination or mixtures or sequences to be safest in all cases, or any class of cases, would be a reflection on the intelligence of my hearers; for you well know that in this work there should be no routine.

VARIETY OF ANESTHETICS.

When one sees the great variety of agents, and complicated apparatus being used, in many instances by incompetent anesthetists, and the recklessness with which the hazardous risk is approached today, the first thought is very much like the impression the country man gets when he is whirled through the streets of our crowded cities in an automobile. He wonders why more people are not hurt, when the facts are a great many more are hurt than he supposes. Just so with our anesthesia. We are having

*Read during the Sixth Annual Meeting of the American Association of Anesthetists, Auditorium Hotel, Chicago, Ills., June 10-11, 1918.

an untold and alarming number of anesthesia deaths —most of them never being heard of outside of the immediate surroundings in which they occur.

WHERE DEATHS OCCUR.

This deplorable condition of affairs is largely due to the fact that anesthesia deaths seldom occur in the practice of our noted surgeons, who throw around their patients every known precaution, and who work in large, well-managed institutions, from which we get complete and instructive data. The larger percentage of anesthetics are administered outside of hospitals and in small and medium-sized institutions, where the facilities for doing scientific work and keeping records are far from ideal; and it is in this class of work that most deaths occur. Furthermore, it is this element of the profession that we find most dilatory about holding up for inspection such misfortunes as might reflect on their reputations and interfere with their income.

INCREASE OF FATALITIES.

Since it is impossible to get the whole truth about this subject, I will have to ask you to pardon me for giving an opinion, which is that we are getting one anesthesia death today in about every one thousand administrations, taking all general anesthetics as a basis. This includes all cases chargeable to the anesthetic, the surgeon, and the hazardous risk. This sounds discouraging and exaggerated—for Fleming, Miller, Teter and others have gathered statistics much more favorable; but their figures have been compiled from the records of our best institutions, and many of them are not of recent years, and include only the ones chargeable to the anesthetic. Unless my estimation is far wrong, our anesthesia death rate is increasing, and not improving as it should be. Therefore, it behooves us to try to find the cause and correct it.

CAUSES OF DEATH.

In my judgment, there are a number of factors responsible.

First:—It is the trend of the times to minimize the importance of anesthesia, and our anesthetists today are less skilled and more careless than ever before.

Second:—All sorts of drugs and mixtures are being used, frequently in a spirit of experimentation, by incompetent and unscrupulous anesthetists in a large percentage of the work. Therefore, alarming consequences are naturally resulting. It is to be regretted that we have utterly failed thus far to standardize general anesthesia and anesthetists to any satisfactory degree.

Third:—Another reason for a pardonable increase is the fact that we are undertaking to do surgery on more and more hazardous risks, as time goes on. And as we become more skilled and provided with better means to combat the causes of such deaths, it is our duty to lend a helping hand to a certain class of hazardous risks on whom we have turned our backs in the past, and denied them their only chance. This state of affairs will naturally result in more sudden deaths on the table; and it should not be our ambition to build up favorable statistics. On the other hand, it is our plain duty to serve the sick and afflicted, forgetting our own reputations, and with but one thought, and that is to apply the Golden Rule in every case, and do for the patient as we would want to be done for.

Fourth:—The chief cause is the untrained and reckless surgeon, whose indifferent attitude and conscience allow him to use the interne anesthetist, or doctor who gives anesthetics *on the side,* or someone else without fundamental medical education, who does the work on a contract basis as a matter of routine, and usually looks on the procedure with over-confidence or a criminal indifference.

These would-be surgeons not only use bad judgment in selecting the anesthetist, but usually also the drugs and methods. They individually presume to pass on the patient's fitness to undergo the operation, and as a rule, order all preparation, even the preanesthetic hypodermic, without due consultation with an internist or the anesthetist.

The anesthetist sees the patient for the first time in the operating room, begins the anesthetic without knowing anything about the risk, whether or not it is particularly hazardous; and without regard for such precautionary and protecting measures as may be definitely indicated.

I am glad to say for my confreres that this type of surgeon belongs to the small minority, but I fear they are on the increase, and if this is true, it is sufficient justification for the belief that sudden deaths on the table are becoming more frequent.

CLASSIFICATIONS.

To get at something like a classification of the fatalities under discussion, we must make an effort to fix the blame on someone for all deaths occurring during general anesthesia and immediately following it, being caused directly or indirectly by the anesthetic agent or other drugs given in connection with it, or to any procedure to which the patient is subjected while anesthetized.

It is necessary to further divide the deaths into the ones that might have been averted had certain precautionary measures been instituted, and the

ones caused by agencies over which the anesthetist and surgeon could not have had any control.

To place the responsibility of such a death is a most difficult task, and will usually require a thorough investigation of all the facts and a candid report, regardless of where the burden falls.

ANESTHETIST'S RESPONSIBILITY.

No progress can be made until we establish the relationship of the anesthetist and surgeon. If the anesthetist is of the doormat variety, he is not responsible for anything that happens; but if he is allowed to use his own initiative in the selection of the drugs and methods, and his discretion as to the patient's ability to take the anesthetic, and does his work with a free hand, he certainly should be held to account for such accidents as cannot be fairly charged to the surgeon or the hazardous risk.

SURGEON'S RESPONSIBILITY.

If the anesthesia is satisfactory, and the surgeon by slow, bunglesome, or reckless methods loses an unwarranted quantity of blood, and adds a fatal shock by trauma and bad technic, the responsibility is absolutely his.

HAZARDOUS RISKS.

When every precaution has been employed to investigate and judge the patient's condition, and death occurs on the table under ideal anesthesia during the progress of a well-planned and skilfully performed operation, the accident should be looked on as unavoidable, and the anesthetist and surgeon should not be censured.

Deaths will occur in the best surgeon's work, where the best anesthesia has been produced—deaths that surprise and shock us, being the natural consequences of subjecting a certain class of patients to the mental and physical strain necessarily accompanying the procedure as a whole to which they are subjected in our efforts to relieve them.

To circumvent such mortality we have searched for newer and safer combinations to anesthetize certain classes of cases, and in some of our efforts we have wandered far afield, only to realize the urgent necessity of returning to our old friends—drugs and methods long since mastered and proven worthy.

DEFINITE CAUSES.

In the light of our present facilities we can certainly definitely place the responsibility in nearly all cases. There should be very little element of doubt as to just what brought about the fatality when the patient dies of—

(1) Shock.

(2) Hemorrhage, primary or secondary.

(3) Overdose of the drug, paralyzing the higher centers.

(4) Underdose, where heart fibrilation or paralysis occurred.

(5) Acute dilatation.

(6) Acapnia.

(7) Postoperative pneumonia; or

(8) Acidosis.

But occasionally some rare pathological lesion, such as lymphaticus, or embolus, will be the underlying cause, and well nigh impossible to locate.

THE REMEDY—CONSULTATION.

With this bewildering complexity confronting us, what can be done to better the situation? *First*:—A definite consultation should be held by the surgeon and anesthetist in every case, be it ever so brief. The salient points of a given case can be discussed rapidly and satisfactorily by workers who are in close contact, and precautions inaugurated, when indicated, that will result in greater safety for the patient.

SAFEST DRUGS.

Second:—We must, as anesthetists and surgeons, with our co-workers, insist on the safest drugs, considering always the individual patient and the experience and training of the anesthetist.

PREPARATION OF PATIENT.

Third:—The preparation of the patient should be carefully carried out, and many post-operative complications directly traceable to the present day curse of hurrying into our cases without sufficient time to study the patient's needs will be averted.

SELECTION OF HEART CASES.

Fourth:—Greater precautions should be used in the selection of doubtful heart cases. Cashman has studied the pulse pressure test in preoperative estimation of the reserve strength of the cardiovascular system, and says the patients with little reserve, and who respond so poorly to light strain should no more be subjected to a severe operation than to a cross country run.

Crotti in his book on "Thyroid and Thymus" recommends the Katzenstein test for functional capacity of the heart, and says that he has employed it with great satisfaction for the last four years. This test is particularly applicable to goiter and other cases where myocardial degeneration is suspected, frequently found complicating gall-bladder disease, and in that type of patients who are operated on for prolapse and fibroids, the middle-aged women with overweight. He says the test is very accurate and valuable; and every time cardiac postoperative complications have occurred in his work, the Katzenstein test previously made had been positive.

PURITY OF AGENT.

Fifth:—Strict attention should be given to the purity of the agent used by the anesthetist. Dr. Herb calls attention to the danger of using impure drugs, and warns against the administration of ether which forms snow on the wick when left standing, or freezes on the cone. Warner has pointed out the danger of impure gas, and his work has done much to remedy the evil. There is abundant evidence to prove the danger of chloroform which has undergone changes, and it is not only dangerous during its administration, but also in its delayed effects.

THE FINE POINTS OF ADMINISTRATION.

Sixth:—The technic of administration is a most vital issue in the prevention of death, both primary and secondary.

ALL METHODS DANGEROUS.

There is one thought that must never leave us, and that is that all anesthetic agents, general or local, are more or less dangerous, and that the ideal anesthetic agent and method has not been found.

IMPORTANCE OF MEDICAL EDUCATION.

When one studies the work of that master in this field, Yandell Henderson, he is impressed with the importance of employing an anesthetist whose education is well grounded on a scientific foundation; and it is unreasonable to expect the untrained mind to grasp many of the intricate problems daily confronting the anesthetist.

DANGER OF PARTIAL ANESTHESIA.

Levy and others have shown conclusively that it is during light or partial anesthesia that chloroform and other anesthetic agents are so dangerous, and that cardiac fibrillation and paralysis are most apt to occur at this time, and when the patient is coming out, or having the drug reapplied, just when the amateur anesthetist thinks he is doing fine keeping the patient under very light or partial anesthesia. We all know that there is such a thing as giving an overdose of the anesthetic, but this is the exception and not the rule, when death occurs.

CONCENTRATION OF VAPOR.

The concentration of ether vapor is an important factor in the production of postoperative pneumonia. Dr. Herb warns against the intermittent administration of the drug, which allows the signs of returning consciousness to appear, at which time the anesthetist in his haste to get the patient under again, concentrates the vapor until it is above the safety margin—six or seven per cent—and says that a highly concentrated vapor will do more injury to lung epithelium in a few minutes than a dilute vapor will during a long anesthetic. Any concentration of ether vapor which produces coughing as the patient goes under is dangerous, and if continued, and complications result, the responsibility rests on the anesthetist absolutely.

POSTOPERATIVE PNEUMONIA.

The work of Armstrong, Whipple, Bancroft, McKesson, and others who have collected a large series of cases with about three per cent of lung complications and a total mortality of a little more than one per cent, brings out the great importance of this postoperative fatality, which belongs largely to the anesthetist. They warn the anesthetist about his responsibility when he allows the patient to struggle for inhalation through mucus and by a malplaced tongue, which may bring about such exaggerated negative pressure that an edema of the lungs is produced with an excessive flow of fluid into the alevolar cavity, reducing the resistance of the tissues, and inviting the onset of coagulation.

McKesson suggests as the remedy for reducing these too frequent pulmonary complications that more attention be paid to maintaining the body heat of the patient at all times, and especially during the trip from the operating room to the patient's bed, the keeping open of the air passages from obstruction, changing the patient's position at frequent intervals during the first week; the elimination of tight binders over the diaphragm; the encouragement of full breathing; and especially the avoidance of the administration of ether where it is contraindicated.

Homans divides these postoperative lung complications into three classes: *First*:—Those directly dependent upon the narcosis and resulting from the inhalation or aspiration of septic material from around the teeth, tonsils, and nasal mucous membranes into the lungs. *Second*:—Hypostatic pneumonia, depending upon feebleness of the circulation. *Third*:—Definite pulmonary emboli.

The first division; namely, aspiration of septic material, falls largely to the anesthetist, as it is his business to keep the mouth free from froth, and not allow it to be churned back and forth until it is finally aspirated into the bronchial tree. The system of preparation of the patient inaugurated by the surgeon should include previous proper oral hygiene, however, and therefore the surgeon comes in for a liberal share of this responsibility.

MENTAL CONDITION.

Seventh:—More attention should be paid to the mental preparation of the patient; the so-called *psychological atmosphere* cannot be over estimated, and this problem is largely up to the anesthetist,

who with real brains and tact can work wonders in this field of endeavor.

Ferguson has told us that the question of fright is an ever present problem in practically all cases. In some instances the best results are obtained from the efforts of the surgeon, who should never be too busy or too indifferent to attend to the mental comfort of his patient. In some cases the medical man in charge is more powerful in reassuring the patient who has implicit confidence in him. But in all cases, it is clearly up to the anesthetist to get acquainted with the patient, and to exercise sufficient reassurance to establish in the patient's mind absolute confidence; first, in his honesty of purpose to administer a gentle, painstaking, and careful anesthetic; and second, to prove that he is thoroughly capable of doing his work. If we fail in our efforts, and the patient comes to the operation room extremely nervous and badly frightened, the operation should be postponed.

BLOOD PRESSURE.

Eighth:—Particular attention should be paid to the value of blood pressure where serious surgery is being done. The institution of this precautionary measure is a joint responsibility shared by the anesthetist and the surgeon alike, and guides both as to what *not to do* to a very accurate degree.

IMPORTANCE OF EARLY RECOGNITION OF DANGER SIGNALS.

The milk in the cocoanut is, after all, for the anesthetist to stay awake, and talk to the patient, and to no one else, because the greatest opportunity to prevent anesthesia deaths is in the hands of the anesthetist, who must recognize the danger signals before it is too late. To watch constantly the blood pressure, the pulse rate, the behavior of the pupil, the color of the skin, and the respiratory rhythm, will engage the entire attention of a master mind; and the anesthetist who goes to sleep on the job, or engages in distracting conversation and amusement while conducting a human being through the critical stage of suspended animation is absolutely unfit for the work, and should be denied the responsibility. The anesthetist can save the lives of many people by being eternally energetic and untiring in his efforts to discharge the sacred obligation he has assumed.

I agree heartily with Gallagher, who says that: "Improvements in anesthesia have done more to lessen surgical mortality than any other one thing since the discovery of asepsis"; and: "That a thorough co-operation between the surgeon and the anesthetist is absolutely necessary to the working out of the proper technic required to enable the surgeon to avail himself of the very best results in anesthesia for the benefit of his patient."

SURGEON'S RESPONSIBILITY.

If we ask the anesthetist to do so much, the surgeon certainly should be willing to do something, and I would suggest to the surgeon that he work constantly with the best internist and anesthetist to be had; that he take plenty of time to study his cases before operation; that he refrain from the great temptation of doing too many operations at one sitting; and that he never pull teeth and do tonsillectomies on abdominal and other major cases under the same anesthesia; and that above all, he stand with, and not against, the professional anesthetist.

The surgeons of this country could largely correct the present-day evils in this field, if they would turn their attention vigorously and unselfishly to it; and this I believe they will do; for, as a rule, the surgeon who sees that he gets the best anesthesia to be had under the circumstances is also a rapid and skillful operator, who has developed a high grade of technic, and is possessed of good judgment and a keen conscience.

I regret that I cannot bring to you original, or research data; but the literature is teeming with the brilliant results of your own labor; and I have endeavored to discuss the subject briefly in my feeble way from the standpoint of the surgeon only. I am glad to bring a message of our appreciation of your past efforts, and an expression of our gratitude for what you have already accomplished; and to frankly confess our dependency on you for satisfactory results in our work, and to pledge ourselves to a closer cooperation and a more elevated standard of anesthesia.

SUGGESTION TO IMPROVE PRESENT CONDITION.

I desire to bring one suggestion; and that is that this association, through its president, secretary, and one other member chosen from its membership by the president, form a committee to draft a blank to be furnished to all hospitals, and others on request, on which sudden deaths on the table, chargeable to the anesthetist, the surgeon, or the hazardous risk be reported in detail, that a definite collection of data may be built up from which to draw conclusions in the future. Such a system of records will, in my judgment, *First*:—Do much to promote general interest in the subject of anesthesia. *Second*:—It will bring the anesthetist and surgeon and their coworkers closer together on a more satisfactory working basis; and expose our faults to such a degree that unscientific methods will be forsaken, and indifferent workers stimulated to a more

conscientious attitude. *Third*:—It will establish a definite standard to guide us in the choice of anesthetic agents, and their various modifications and sequences and methods of administration in certain classes of cases and under certain circumstances. *Fourth*:—It will undoubtedly prove the great benefits to be derived from the employment of the skilled anesthetist, and establish him where he belongs in the front ranks of the specialists of our profession. *Fifth*:—It will revise to a surprising degree our present statistics, and hold up to the public gaze the real seriousness and great importance of this subject. It will get at the facts, and bring us all to the realization of our sacred obligation to the patient.

DISCUSSION.

DR. WM. HAMILTON LONG, Louisville, Ky.—It is my impression that once shown the advantages of skilled anesthesia the progressive surgeon will have no other kind; and so far as patients are concerned they are even more appreciative of the comfort it assures them as well as the protection it affords. The Louisville City Hospital several years ago adopted a rather revolutionary policy of appointing a number of visiting-anesthetists to supervise the administration of anesthesia in that institution. The plan has worked admirably and has done much to spread the use of expert anesthetists by others in the profession. Its greatest benefit has been a material reduction in the death rate. In England several progressive coroners have forced certain hospitals to adopt this same plan of appointing visiting anesthetists with similarly satisfactory results.

DR. M. SALZER, Cincinnati, Ohio.—Some years ago I collected statistics from various coroners in some of the larger cities of the country and was surprised to find that they showed about the same death-rate as Dr. Sanders' calculation, viz., one to one thousand. In the course of ten year periods these coroners' statistics remained just about the same, indicating rather conclusively that anesthetic fatalities are a fixed certainty. These statistics are no doubt about as accurate as can be arrived at as a comparison with the anesthetic mortality in certain hospitals doing about 65 per cent. of the surgery in a given community show a rate of one anestheic death to eight hundred administrations. I had intended incorporating my statistics in a paper with names, dates and details, but was disuaded by surgeon friends who pointed out that an unfair impression would be created in that some communities enforced the reporting of anesthetic fatalities while others did not. A great deal of benefit would result if all coroners made it compulsory to report anesthetic and operative fatalities and if all concerned would honestly strive to clear-up the nature of post-operative deaths in their mortality statistics. One fact is of striking interest and that is this. Many institutions using internes as anesthetists and pursuing the policy of using them as anesthetists immediately on their entrance, show a decided anesthetic death rate at the periods of changing service. Such institutions should change their policy and use internes as anesthetists at the end of their interneships and then only after proper instruction and under supervision at the start.

DR. ORVAL J. CUNNINGHAM, Kansas City, Kan.—The average anesthetic death-rate is a great deal lower than anyone cares to admit. There is scarcely a community in the country that cannot record its anesthetic death, and in many of these there have certainly not been over two hundred and fifty operations. I am inclined to place the death rate at less than one in five hundred. It would seem important also to reiterate again and again that although the immediate risk of death is almost negligible with expert anesthesia, there are still entirely too many postoperative deaths from remote causes that are avoidable. Acidosis, intestinal paresis, reduced phagacytosis, pnuemonitis, cardiac dilatation and other postoperative complications have opened our eyes to the fact that an operation may be most successful but that the patient may die just the same, much to the chagrin of all concerned. While the chapters on these complications have been written into the literature of surgery and anesthesia, they remain to be introduced into the surgical and anesthetic regime of many clinics. Frequently patients who have experienced the beneficence of expert anesthesia will accomplish much in advertising its advantages to their friends and thus public opinion has in many instances been responsible for progress in obviating anesthetic fatalities when surgical opinion took no interest in the matter.

DR. BEN MORGAN, Chicago, Ill.—Clear-cut anesthetic deaths do occur in many hospitals and are almost invariably due to incompetence or carelessness. Locally, where experts in anesthesia are not used extensively and most anesthesias are given by nonmedical persons, the death-rate is high in comparison with the number of operations performed. But the actual deaths are incomparably small in proportion to the number of avoidable postoperative deaths from complications that are the direct result of poor anesthesia. Unfortunately too many surgeons are still content to submit their patients to haphazard methods of anesthesia and unskilled anesthetists, not realizing that with the cooperation of a specialist in anesthesia, delay and complications can be avoided, and the moment of beginning an uneventful recovery can practically be predetermined by the competent surgical team.

DR. SANDERS (Closing).—The information coming back to me from the front is all to the effect that in this maelstrom of war and the overwhelming influx of wounded the thousands of surgeons who are working in the evacuation and base hospitals are beginning in some measure to realize the dependence of their surgical work on the specialist in anesthesia who are braving the dangers of the Hun air-raids at their side. When these surgeons return to civil practice they will bring back with them the utter conviction that the specialty of anesthesia has its place at the head of their operating tables and at the bedsides of their most hazardous cases.

131 EIGHTH AVE. N.

THERE ARE SEVERAL WAYS IN WHICH YOU CAN HELP IN ORGANIZING YOUR SPECIALTY. MAKE IT A POINT TO OBTAIN THE APPLICATIONS OF SEVERAL ANESTHETISTS FOR MEMBERSHIP IN ONE OR OTHER OF THE SEVERAL ASSOCIATIONS NOW TRYING TO COVER THE FIELD. THE COMRADESHIP AND INTERCHANGE OF IDEAS AT THE MEETINGS WILL BE RECOMPENSE SUFFICIENT FOR THEIR EFFORT IN ATTENDING THE MEETINGS. ALSO IT IS IMPORTANT FOR EACH ANESTHETIST, WHO HAS THE WELFARE OF THE SPECIALTY AT HEART, TO SEE TO IT THAT THERE ARE ENOUGH COMPETENT ANESTHETISTS IN HIS COMMUNITY TO SERVE ALL PURPOSES. WHEN EXPERT SERVICE IS EVERYWHERE AVAILABLE AND HOSPITALS, SURGEONS AND PATIENTS BEGIN TO APPRECIATE ITS VALUE AND COMFORT, THE FUTURE STATUS OF THE SPECIALTY IS ASSURED. DO NOT IMAGINE FOR A MOMENT THAT OTHER ANESTHETISTS WILL CUT-IN ON YOUR PRACTICE. ON THE CONTRARY THEY WILL DEVELOP THAT MUCH MORE NEW PRACTICE FOR YOU TO SHARE.

FACTORS OF SAFETY IN ABDOMINAL HYSTERECTOMY.*

DONALD GUTHRIE, M. D.
Surgeon to Robert Packer Hospital.
SAYRE, PA.

The modern methods of preparing patients for operation, the improvement in the operative technic and anesthesia, and intelligent postoperative care, have made the operation of abdominal hysterectomy a safe procedure. In reviewing our 551 hysterectomies of all types performed in the last seven and one-half years, we are impressed with the following factors of safety:

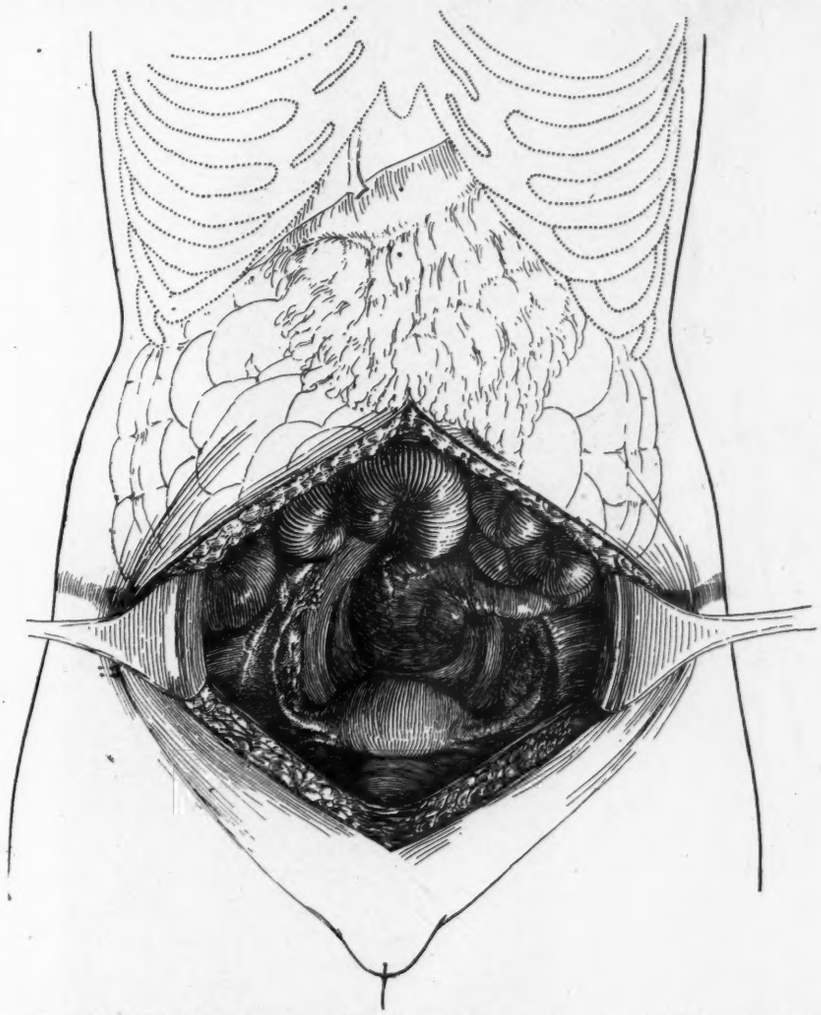


Fig. 1.—Trendelenburg Anesthesia. Showing the coils of small intestine gravitated out of the pelvis when the patient is anesthetized in the Trendelenburg position.

PREPARATION OF THE PATIENT.

First: The preparation of the patient. It is important for the surgeon to know the exact physical condition of every patient presenting herself for operation. This necessitates careful history taking, careful examination of the chest, the circulation, the condition of the blood stream, the nervous system, and kidney efficiency. Patients who have suffered severe loss of blood at the menstrual time we believe should be operated upon just before the onset of the next period, giving the body a chance to recover from the last severe hemorrhage. Women with severe metorrhagia, flowing at the time of examination, should be given salines, and tonics, and such measures should be carried out that will tend to stop the hemorrhage and give the body a chance to recuperate. If the hemoglobin is reduced below 40 per cent. and the bleeding cannot be controlled, direct transfusion of blood from some blood relation is a valuable aid in the preparation as was borne out in five of our cases. I am satisfied these patients could not have stood operation had not transfusion been performed.

Two factors which promote postoperative shock are *loss of sleep* and *dehydration*. In our preparation of patients for any abdominal operation we consider these two factors carefully. In nervous excitable cases with insomnia we advise a few days'

*Read before the Joint Session of the Interstate Association of Anesthetists and the Indiana State Medical Association, Hotel Claypool, Indianapolis, Ind., Sept. 25-27, 1918.

rest in the hospital, and are careful to see that these patients sleep well at night.

We do not employ preoperative purgation in any form, believing that it is not only a useless measure, but a harmful one. Large amounts of fluid are lost by the purge and a night which should be spent in comfort and rest is made a veritable nightmare. Alvarez and Taylor have shown experimentally that the purged gut is less able to empty itself and is more distended than one that has not been purged. All surgeons have noticed how much easier it is to operate upon the emergency case with the collapsed bowel than upon those who have been thoroughly prepared with their empty but distended coils, and yet, we all have been slow to realize that purgation is not only unnecessary but harmful.

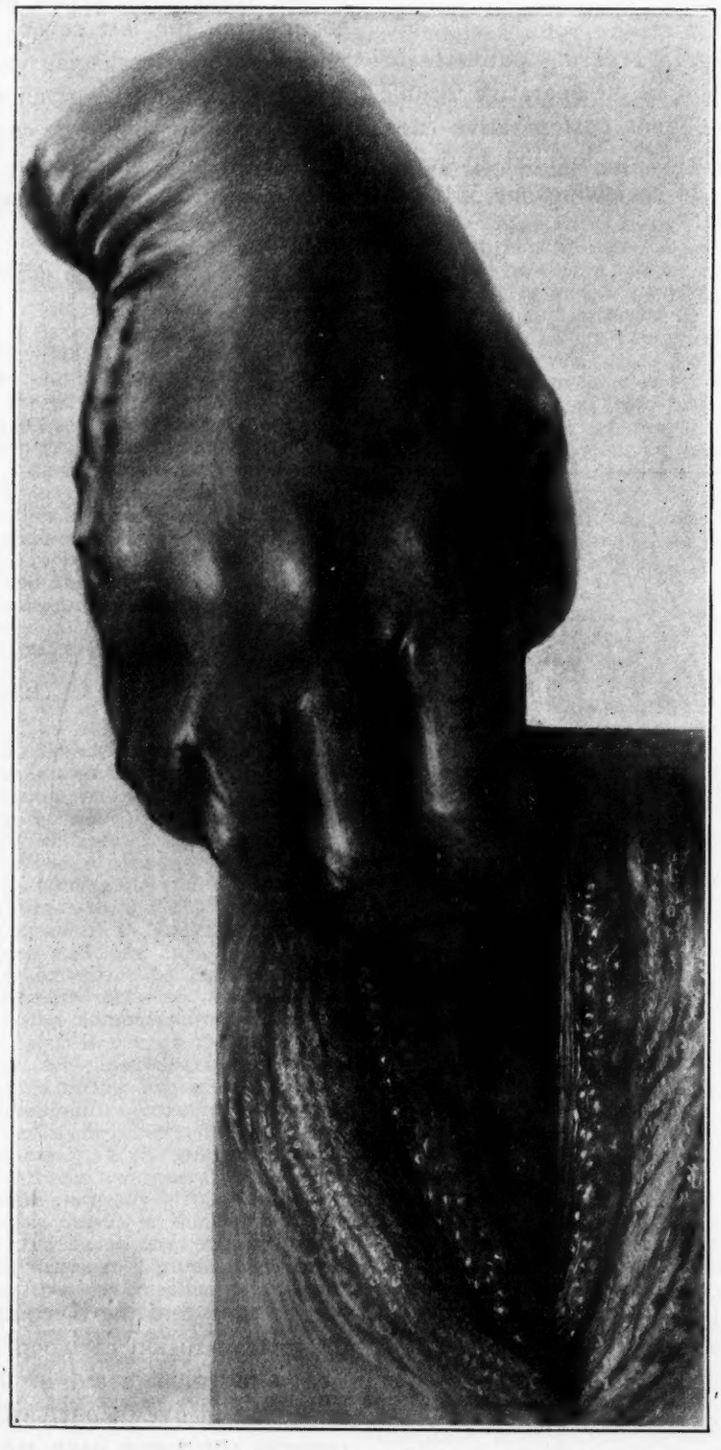


Fig. 2.—Lifting up abdominal wall to free pelvis of any coil of small intestine.

We rely upon a morning enema to empty the lower bowel, except in the patient who is obstinately

constipated. She is given a small dose of cascara the night before operation and the morning enema. If the operation does not come until late in the morning we allow our patients hot coffee, tea, or broth when they are awakened.

We plan to have the patients lose as little fluid as possible on the operating table; therefore, our operating rooms are at normal room temperature instead of excessively hot. The patients are not wrapped in blankets, and no measures are taken to keep the operating table warm. It is seldom necessary to change the patient's night garment on the table after the operation is over because of perspiration.

In all cases of hysterectomy the patients are shaved in the afternoon and the abdomen treated with tincture of iodin. This is repeated just before operation. In addition the vagina is washed out well with soap and water, and a 1 to 5,000 bichlorid douche given. This is repeated on the table should the case be one for complete hysterectomy.

SKILLED ANESTHETIST AND TRENDELENBURG ANESTHESIA.

The value of good anesthesia by a trained anesthetist cannot be too strongly advised. The responsibility of the anesthetist in major operations is next to that of the surgeon. Most hospitals today have the services of skilled anesthetists. The personality of the anesthetist is most important, for he or she can by skilled suggestion calm the most nervous patient. In all of our cases of pelvic surgery we employ the Trendelenburg anesthesia. The anesthetic is started with the patient in the Trendelenburg position on the operating table. It is not necessary to have all patients come to the operating room, but if the anesthetic is given in an anesthetizing room the patient is put to sleep in the Trendelenburg position on the table which is to be used during the opera-

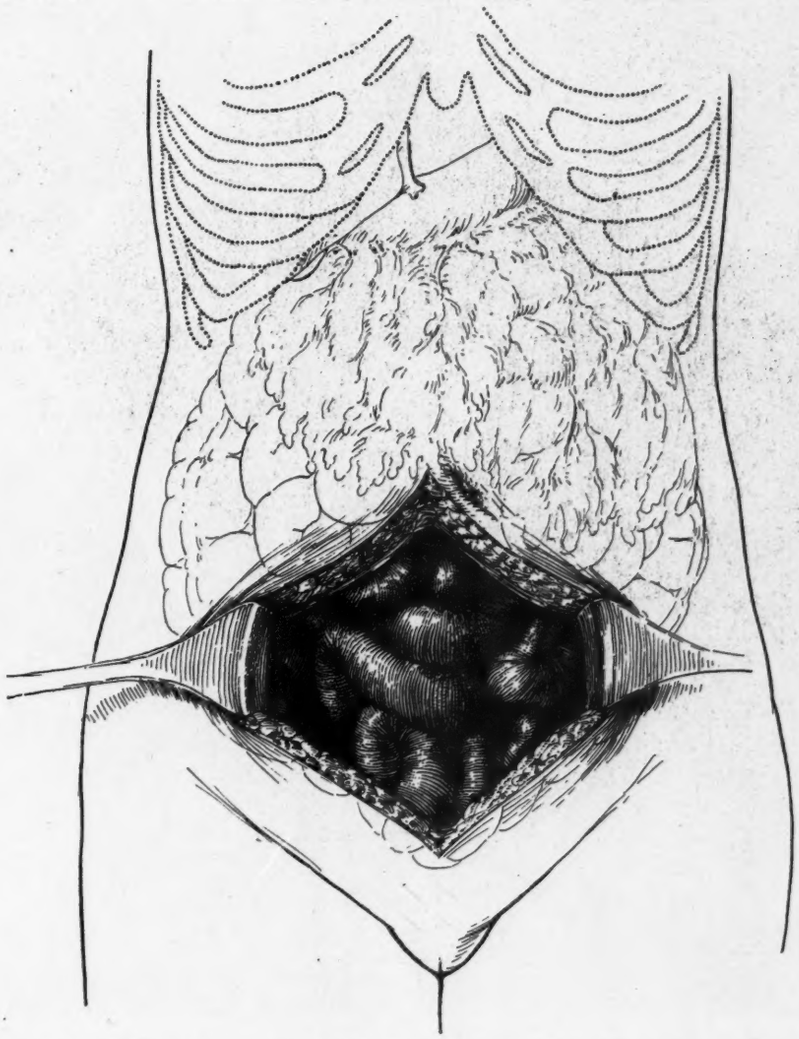


Fig. 3.—Compare the difference in the amount of small intestine in the pelvis when the patient is anesthetized in the dorsal position.

tion. Here, the personality of the anesthetist is most important, for by suggestion the fears of the patient caused by the slight discomfort in beginning the anesthetic in this position, can be allayed.

We all know that trauma to the small intestine is a great factor in the production of shock. In this type of anesthesia it is planned to have the small intestine out of the pelvis when the abdomen is opened. If Trendelenburg anesthesia is used it is usual to find but a coil or two of small intestine in the pelvis, and it is seldom ever necessary to use more than one small square of gauze to get excellent exposure (Fig. 1), When we open the peritoneum we insert two fingers into the abdomen and lift the abdominal walls well up (Fig. 2) the inrushing air will cause any coil of intestine that has not gravitated out of the pelvis to slide upward. When this method is compared with the one usually employed, of putting the patient to sleep in the dorsal position, making the incision, then calling for the Trendelenburg position, it is amazing to see the difference in the amount of gauze used to obtain exposure (Fig. 3). Trauma to the small intestine varies with the amount of packing necessary. We consider this method one of the safe factors in preventing shock in pelvic operations. Should the pelvis not be infected the gallbladder is explored by touch before packing is inserted. If gallstones are found the question as to whether or not they should be attended to depends upon the condition of the patient at the end of the pelvic operation. The appendix is always removed after hysterectomy unless some critical state of the patient contraindicates its removal.

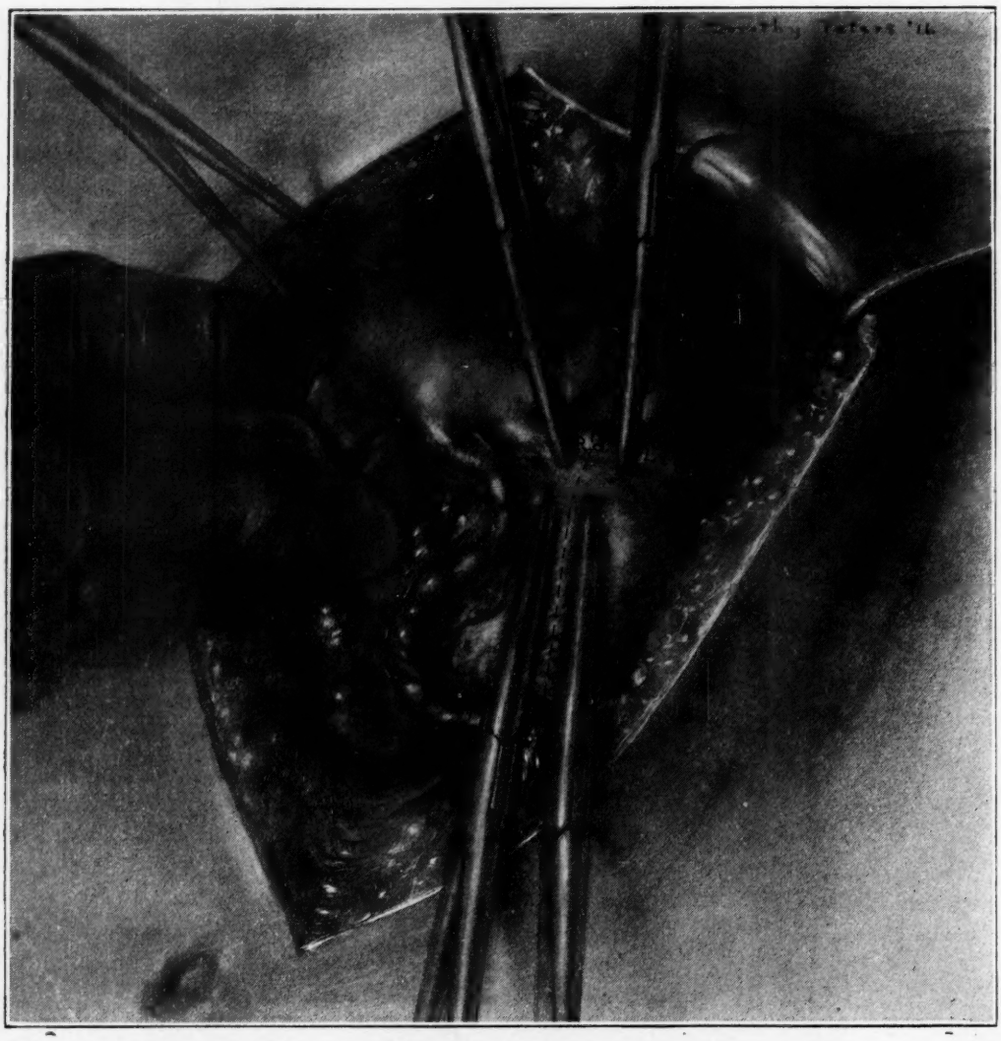


Fig. 4.—Forceps applied to broad ligaments, including ovarian arteries, and forceps placed on round ligaments.

THE SURGICAL TECHNIC.

In our operation for abdominal hysterectomy we use the clamp method, clamping and cutting first the broad ligaments containing the ovarian arteries on both sides, next the round ligaments separately (Fig. 4). After freeing the uterus

on both sides in this manner we dissect the fold of the peritoneum on the anterior surface of the uterus, push the bladder forward, then isolate the uterine vessels on both sides and cut between the clamps (Fig. 5). The cervical canal is wiped off with gauze wet in bichlorid. We do not use any strong antiseptic here, fearing that if a slough is produced it may favor intestinal adhesions. In two of our earlier cases the patients had to be operated on for this condition. The objection some few men have to the clamp operation is the fear that it produces thrombosis in the veins. This I do not believe because the results in vaginal hysterectomies where clamps were used are good, and pulmonary embolism is not any more common in this class of work than in any other. Our sutures are placed well behind the clamps and are placed in immediately so that if thrombosis has occurred it would be in the vessel at the distal side of the ligature. We do not use mass ligatures of any kind nor do we use the old pedicle needle. The vessels in the broad ligaments are secured by using a safety tie, then a lock suture throughout. The uterine vessels are ligated after fixing the ligature along the side of the cervix by a safety tie and then securing the vessels firmly by another tie of the same ligature (Fig. 6).

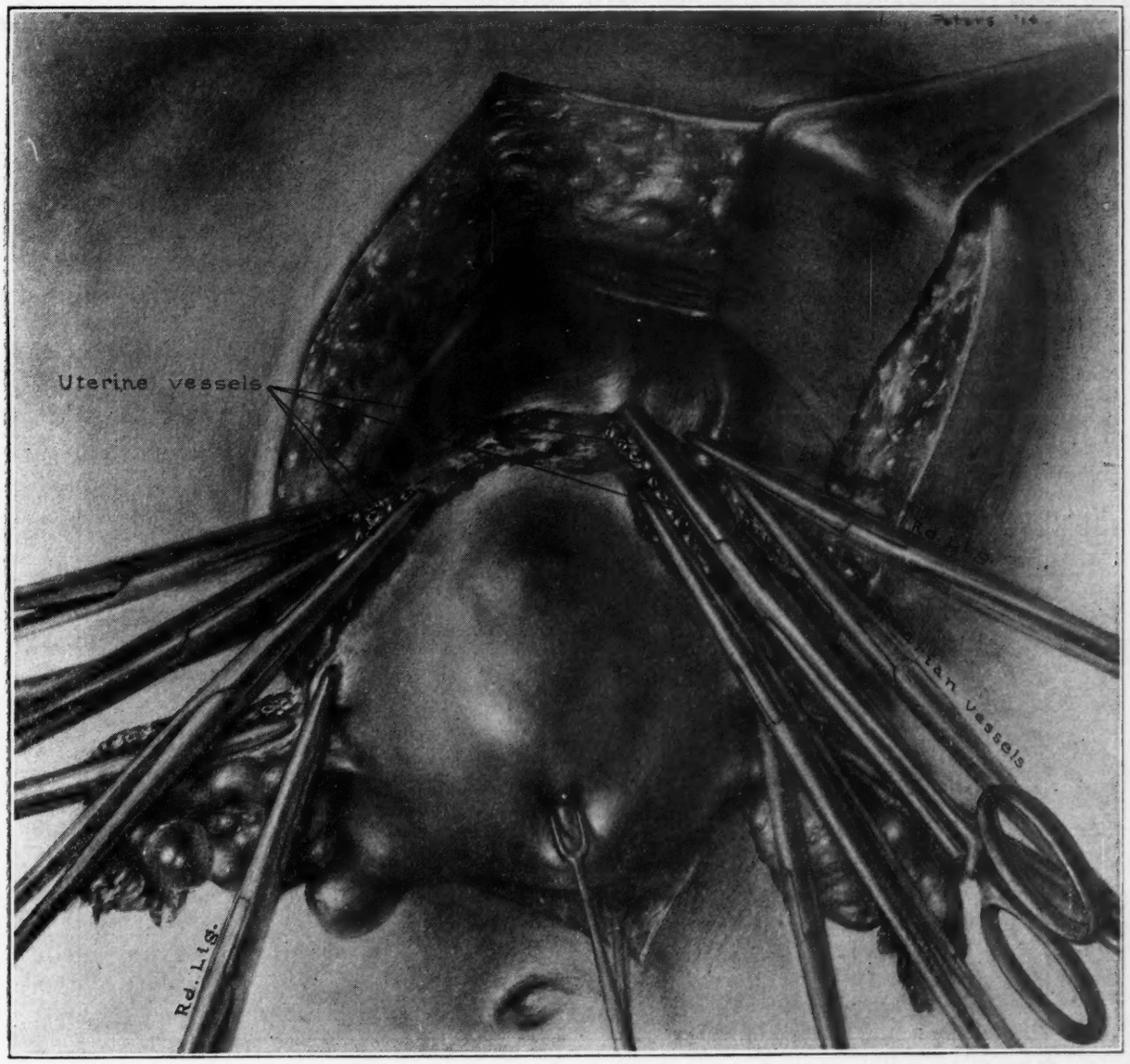


Fig. 5.—Showing uterus freed on all sides. Clamps on uterine vessels. Bladder pushed forward.

If a panhysterectomy is to be performed we isolate the ureters by splitting the posterior peritoneum, following them throughout their course. In a few cases we have used the ureteral catheter passed in the ureter and left in place. This makes it easy to recognize these structures, as they pass close to the cervix. To my knowledge we have never cut or ligated a ureter in a pan-

hysterectomy. In cutting across the body of the cervix we use a conical incision which favors coaptation of the cervical margins. It is most important, I believe, to close up the cervix carefully, and to bring back the anterior peritoneal fold sutured to the posterior peritoneum (Fig. 6). In multiparous women with relaxed vaginal outlets we suture the round ligaments across the cervical body to prevent prolapse of the cervix into the vagina. An equal pull from each side tends to hold the cervix well up in the vagina (Fig. 7). Before closing the abdomen we bring the omentum down into the pelvis, completely covering the operative field, and all coils of the small intestine, which have gravitated back in the pelvis. By so doing, the liability for adhesions is lessened. In the closure of our wounds we use a continuous stitch in the peritoneum and interrupted sutures of chromic catgut in the muscle and fascia. This is a safer method than a continuous stitch. These sutures are not tied tightly.

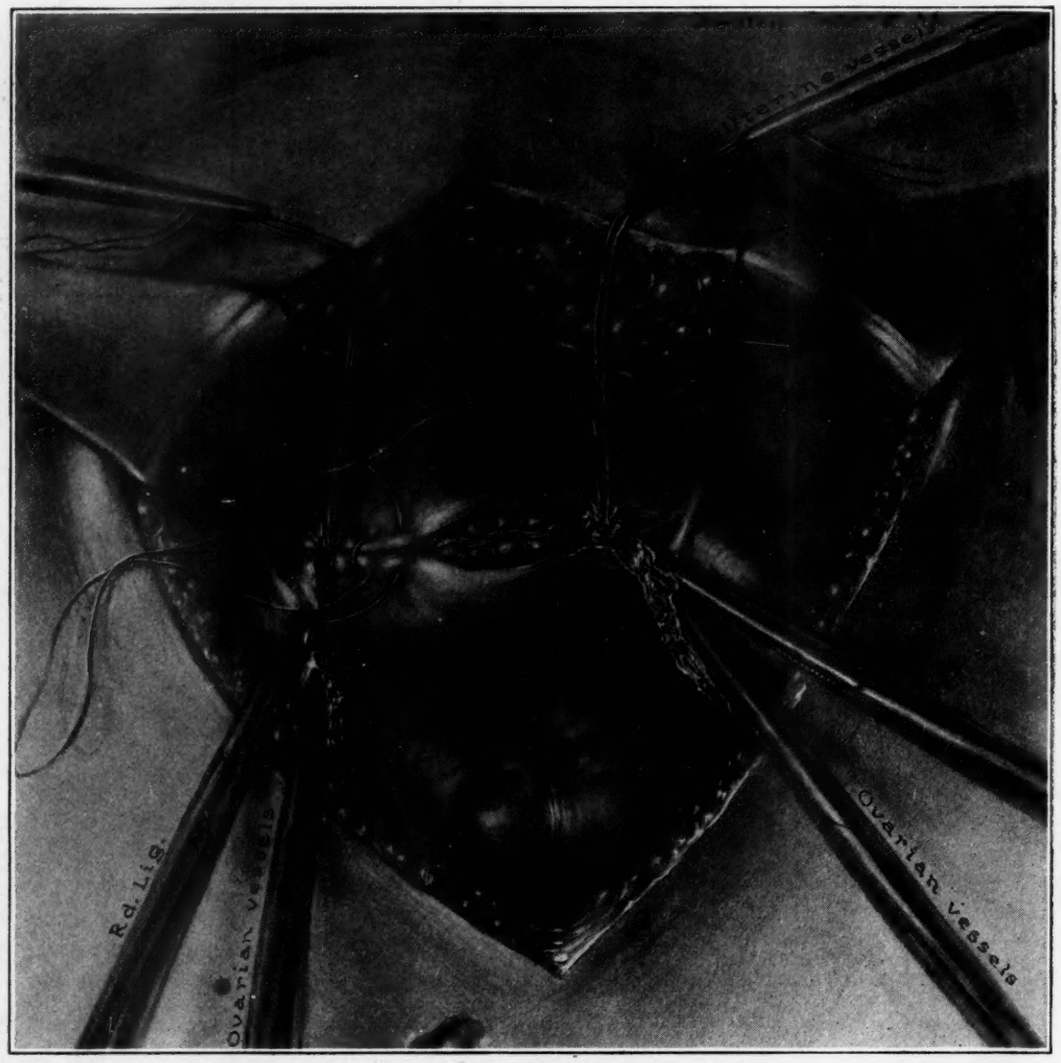


Fig. 6.—Method of securing vessels in broad ligament. Stump of cervix closed and peritoneal folds carefully coaptated.

POSTOPERATIVE CARE.

I cannot advise too strongly that the operating surgeon see his patients daily, and at frequent intervals after operation. The responsibility of the postoperative care of patients should not be entrusted entirely to the house doctors and nurses. Oftentimes complications may be early recognized by the surgeon and combatted, which would be overlooked by subordinates if they had complete care of the patient.

We plan to have our patients made just as comfortable as possible during their postoperative course. They are kept in quiet recovery rooms for the first two or three days in the constant charge of a nurse. As soon as they are awakened they are given by mouth an ounce of olive oil. If they vomit it they get rid of a lot of ether, and it is usually the only time they do

vomit. Fluids by mouth are given early and in large amounts if they are retained. We have discontinued the Murphy drip except for those who are dehydrated and shocked, believing that it causes reverse peristalsis and increases gas pain. Instead we use a large rectal tube left in place for forty-eight hours. Food is given early because it is the best stimulant for peristalsis that we have. Most of our cases of hysterectomy have soft diet on the second day after operation and have a natural bowel movement on the third day.

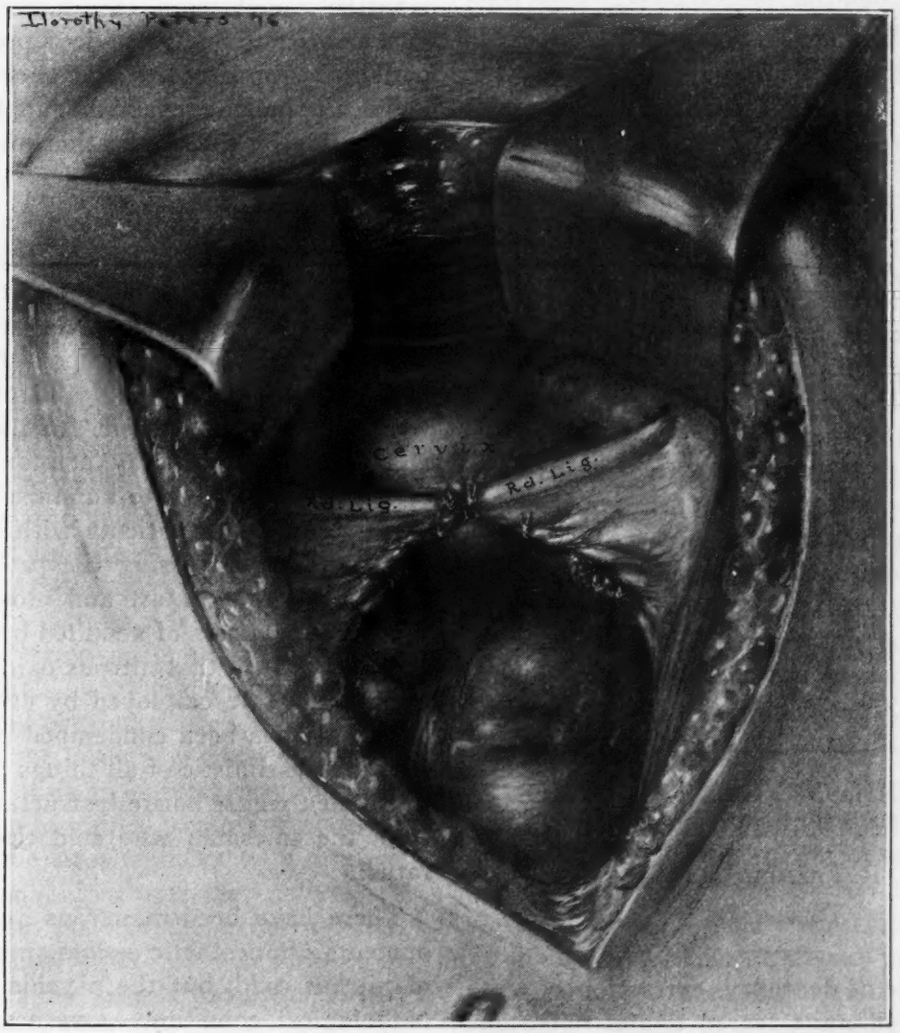


Fig 7.—Showing the round ligaments sutured to cervical stump to prevent prolapse of cervix vagina.

We give 1-6 grain of morphin and 1-150 grain of atropin twenty minutes before anesthesia. Morphin is given frequently but in small amounts for the first forty-eight hours after operation. Our practice is to give 1-12 grain hypodermically every four hours. When the abdomen has not been drained we use a five-pound sand bag for the first three days believing that its weight helps to restore normal intraabdominal pressure and prevents distention. One condition that we watch closely is the postoperative atony of the stomach, which in some cases if not recognized is a precursor of acute dilatation of the stomach, or acute gastromesenteric ileus. Any patient who has regurgitation or vomiting on the second day, or one who is restless, worried, or somewhat distended, has a lavage performed. If there is any tendency at all to acute dilatation, the stomach is washed out every three hours with good hot tap water. We employ all other means possible for retention of the urine other than the catheter. We fear its use and only resort to it when all other methods fail.

RESULTS.

We have had no postoperative hemorrhages in any of our cases, and I did not see a postoperative hemorrhage in the many hundred cases of hysterectomy that I took care of at Rochester. The lock suture in the broad ligament is certain-

ly a safer method than that of mass ligatures.

Two of our patients developed acute obstruction of the bowels due to a loop of the small intestine becoming adherent to the cervical stump. This occurred when we were using the carbolic acid and alcohol treatment of the cervical stump. It is my belief that sloughing occurred which caused these adhesions. Both of these patients were operated upon early during the obstruction; one recovered and one died. Our plan now is to mop off the cervical stump with a weak bichlorid solution.

In the past seven and one-half years we have performed 551 operations of hysterectomy. Out of this number 374 were supravaginal hysterectomies, 63 were complete or panhysterectomies, and 114 were vaginal hysterectomies. We have had 8 deaths or a mortality of 1.4 per cent.

In the series of 374 supravaginal hysterectomies there were three deaths,—two from acute intestinal obstruction and one from acute dilatation of the stomach.

Among the 114 vaginal hysterectomies there were three deaths,—one from general peritonitis, one from pulmonary embolism two weeks after operation, and one from post-operative ileus.

Of the 63 panhysterectomies there were two deaths,—one from pneumonia and one from peritonitis.

Excluding the one unavoidable death from pulmonary embolism the operative mortality for the series is 1.2 per cent.

NITROUS OXID-OXYGEN ANESTHESIA FOR DIFFICULT EXTRACTIONS.*

H. R. FRANCIS, D.D.S.,
TOLEDO, O.

In the history of dentistry, extraction of teeth is the oldest and most feared dental operation. Still, the average dentist has given less thought and study to anesthesia for the elimination of fear and pain, and the technic of this operation than any other dental procedure. With the rapid advancement in other branches of our work, is it not reasonable to expect that this should receive the same consideration, and be kept astride with progress.

Extraction cases, in many instances, are of the greatest importance, requiring the same consideration as any other surgical procedure, for the reason that success is hoped to produce important curative results and failure may result in great injury to the patient.

The dental surgeon, in his anesthetic practice, is at a great disadvantage in many respects as compared with the surgeon. As the majority of extraction cases are of the nature of emergency operations, the anesthetic must be more or less of a corresponding character, therefore, he is often called upon to administer anesthetics in the absence of any previous preparation of the patient, being forced to place his reliance wholly upon the anesthetic agent, supplemental as far as possible by the application of suggestion and his skill in administration.

In selecting an anesthetic agent for extraction operations, it should be one that will produce anesthesia in a reasonably short time, insure a rapid recovery following its withdrawal, and exert no harmful effects upon the vital centers and organs of the body. In nitrous oxid-oxygen, we have an agent which fulfills these requirements. Being practically non-toxic and non-irritating, it is possible to administer it with comparative safety to patients with diseased organisms without increasing the pathological conditions. It is the safest and most flexible anesthetic in the hands of a skilled operator, and history has proven that nitrous oxid alone has been remarkably safe employed by even the inexperienced. It has been condemned mainly by those who are pessimistic of all things progressive, and those men whose entire instruction was obtained from the salesman who sold them a gas apparatus.

There have been numerous and varied developments of anesthetic agents since the discovery of nitrous oxid, but the psychic, as well as the pathological conditions govern the employment or enhance the value in many instances, whereas nitrous oxid-oxygen anesthesia is limited practically by the skill of the anesthetist and will reward the efforts made to master its peculiarities with the most universal success and satisfaction.

The essential requirements in the administration of nitrous oxid-oxygen anesthesia consists in the ability of the anesthetist to determine the proper mixture of gases, according to the requirements, also learning to diagnose the various planes of anesthesia, and employing a machine capable of developing the possibilities of this form of narcosis. In the majority of cases anes-

*Read during the Fourth Annual Meeting of the Interstate Association of Anesthetists, in conjunction with the Indiana State Medical Association, Claypool Hotel, Indianapolis, Ind., September 25-27, 1918.

thesia will be maintained with about 93 per cent. nitrous oxid and 7 per cent. oxygen. However, there is no set rule. We had one case requiring 45 per cent. oxygen. Nitrous oxid is very evanescent in its effects, requiring only a few inhalations one way or the other, to allow a patient to regain consciousness, or to be plunged into a condition of collapse. This explains the necessity of a refined technic.

Patients are not all affected in a like manner by anesthetics. Environment, occupation and habits exert governing influences upon the results obtained. The class of patients who tax the skill of the anesthetist are the alcoholics and the extremely nervous. When it is necessary to deal with such patients, the administration of a preanesthetic hypnotic is found very advantageous. We rarely employ hypnotics in the office, however, on account of the short period usually required for the operation, and the long period for recovery.

In extraction operations, we generally operate in a dental chair, and as a good anesthesia will not be maintained with an obstructed air passage, it is very essential that the head is in a correct position, that is, allowing the neck to follow the long axis of the body. If the head be too far back, it allows the saliva to flow back into the throat, causing a desire to swallow, resulting in restlessness during the induction stage, and is usually followed by nausea. If too far forward with chin nearly resting on chest, it will interfere with respiration. Caution also should be exercised against long continued pressure, without interruption, upon the lower jaw while operating.

When the patient is in correct position, and the mouth has been examined, removing all loose dentures, adjust the nasal inhaler with the exhaling valve open. Instruct the patient to breathe through the nose in the usual manner. Allow the gas to flow sufficiently to force it to the inhaler, adjust the mouth prop, and when everything is running smoothly, place rubber cap over the mouth. The flow of gas is gradually increased, and more tension placed on the exhaling valve spring, which forces the blood to take up a greater volume of nitrous oxid. Anesthetics should not be administered too rapidly, at the same time, watchfulness should tell us the different conditions, and allow us to quickly pass over the excitement stage. When ready to operate, the exhaling valve should be screwed down tight, and the pressure of gas from the machine increased sufficiently to compress the gas in the nasal passages and force the soft palate down upon the dorsum of the tongue, preventing the patient from breathing through the mouth. If this is not sufficient, increase the pressure still more and exclude the air by blowing the gas out the mouth, or use the mouth hook. However, a more economical method is to pack the back part of the mouth with gauze. The gauze method is preferable as it also prevents teeth, or parts of teeth, fillings, blood, and debris from going back into the throat and being swallowed, or inspired into the lungs, causing no end of trouble.

There are two general classes of abnormal cases of extraction—the malposed and malformed teeth. We often find a combination of both classs in a single case. In the malposed class are found the impacted third molars and upper cuspids. This type of case is often complicated by some distorted shape of the tooth, caused by force in its attempt to erupt. In the malformed class are the teeth in which stimulation of the peridental membrane, by infection or pressure, has caused an excessive amount of cementum to be deposited on the roots, resulting in an abnormal development or hypercementosis.

The technic for extraction should be divided into two parts. First, loosening the tooth. Second, removing the tooth from the socket. This procedure should be followed in all types of cases, from the simplest to the most difficult case. If all teeth were normal in shape and position, very simple technic would be required, but unfortunately their condition can seldom be determined until the tooth is out. We may resort to every device intended to assist us in determining the character of the tooth to be removed, but a great deal of uncertainty usually remains, and it is advisable to follow any plan that may help us to avoid the danger of accident.

The method which I employ for the removal of lower impacted third molars is as follows: With a blunt dissecting instrument, dissect the gum tissue, exposing the bone, then employ a drill in a strong engine at a low speed. Insert it on the buccal side along the axis of the root, remove and insert it again slightly at the side of the first hole made, then connect the two canals. Follow this procedure until the socket is enlarged two-thirds the circumference of the tooth. Insert an elevator and loosen the tooth. If the socket is not large enough to permit of the removal of the tooth, enlarge the socket with a surgical bur, or half-round chisel. With this method, the minimum amount of bone is destroyed. The severity of these cases depends entirely upon the degree and depth at which the tooth

is lying, also the density of the surrounding bone.

There are many other types of teeth which present greater problems for their removal than those that are impacted. For instance a lower first or second molar in the mouth of a middle-aged patient. The tooth is very firm to the touch, and there is no soreness. *X*-ray reveals a blind abscess, also hypercementosis of the roots. History: Tooth devitalized twenty or more years before, which means the tooth was devitalized before the texture of the tooth had become dense, and it will be found that it is in the same condition now, only in all those years it has dried out and is exceedingly brittle. There is no peridental membrane remaining. It is like an impacted tooth due to fusion. Such a tooth usually presents an exceedingly difficult problem to remove.

A method for removing such a tooth is to try to luxate with a molar forcep, which will include the body of the tooth between its beaks. If this is not possible, the next step is to separate the roots. For this, I employ a pointed elevator, introducing it at the gingival between the roots, and by a slow rotary movement, force it inward and downward. This removes the septum of bone between the roots, and occasionally one or the other of the roots will be loosened. If, however, neither root is loosened, introduce a flat wedge-shaped elevator between the distal root and molar, slowly working it downward, forcing the root into the space made by the pointed elevator, then repeat the method on the mesial root. Great care must be exercised not to encroach upon the teeth not to be extracted.

In conclusion, I would urge anyone in doubt to improve his technic and knowledge of application, for the object after all in our life work, is service—the best we can do for our general uplift, and for the good of humanity, whom we have the honor to serve.

THE SPECIALTY OF ANESTHESIA IS BEGINNING TO COME INTO ITS OWN. A NUMBER OF ASSOCIATIONS OF ANESTHETISTS HAVE BEEN ORGANIZED; AN OFFICIAL ORGAN HAS BEEN ESTABLISHED FOR THE PUBLICATION OF THEIR TRANSACTIONS AND A YEAR-BOOK HAS BEEN FOUNDED TO COLLATE AND PRESERVE ALL WORTH-WHILE RESEARCHES AND CLINICAL PROGRESS IN PERMANENT FORM. THE QUESTION NOW IS WHAT ARE YOU DOING TO MAKE THESE VITAL ADJUNCTS OF YOUR SPECIALTY A SUCCESS? ARE YOU BRINGING NEW MEMBERS INTO YOUR ASSOCIATIONS OF ANESTHETISTS? ARE YOU PREPARING PAPERS FOR THEIR PROGRAMS? ARE YOU PURSUING ANY RESEARCHES IN THE SCIENCE OR ART OF ANESTHESIA? IF NOT WHY NOT? YOUR SPECIALTY NEEDS YOUR CO-OPERATION.

ANESTHESIA AT THE FRONT

RAPID INDUCTION ANESTHESIA FOR MILITARY SURGERY.

ARTHUR E. GUEDEL, M.D.
Captain, Medical Corps, U. S. Army, Vittel Hospital Center, American Expeditionary Force, France.
INDIANAPOLIS, IND.

The following is an E-C-E Sequence (ethyl chloride, chloroform, ether), by the closed method. The idea is taken from the DePage mixture used in the French clinics, but the formula has been modified. It is of value for the rapid induction of all ether anesthesia and is of especial value as an anesthetic for short operations and the dressing of painful wounds. From the initial application a period of operative anesthesia, lasting from 12 to 20 minutes is obtained. Induction for operation is completed in about 2 minutes.

This report is based upon observations of about 2,000 anesthesias.

MIXTURE.

The modified formula of the mixture is as follows:

One dose

Ether	24 cc.
Chloroform	½ cc.
Ethyl chlorid	5½ cc.
Oil of Orange	⅛ cc.

While the oil of orange is not essential, it serves to render the application of the mixture more pleasant to the patient and this consideration is appreciated. It has been our custom to make up this mixture in four ounce quantities, thus:

Four ounce mixture.

Ether	96 cc.
Chloroform	2 cc.
Ethyl chlorid	22 cc.
Oil of Orange	½ cc.

One ounce of this mixture is the usual dose. Debilitated soldiers required the administration of but ¾ of an ounce, while an occasional robust subject needed 1¼ ounces.

This mixture is stable for 3 or 4 days if kept tightly corked. Care must be used in its mixing and handling as the extreme volatility of the ethyl chlorid causes it to leave the mixture very readily. It should be stored in a cool place.

HOOD OR MASK.

The hood, used for the administration of this mixture, was made as follows: A circle of rubber sheeting was cut to the diameter of 20 to 22 inches. An elastic, purse-string was strung through the faced edge of this circle. This elastic was approximately 15 inches long. The general effect on completion was that of a large bathing or dusting cap. A ventilating hole ½ inch in diameter was cut in the center of the hood. In this hood was placed a gauze-covered cotton pad about ½ inch thick and some 6 to 8 inches square.

METHOD OF APPLICATION.

With the cotton pad resting flat in the upturned hood, one ounce of the mixture is poured at once over the pad and the hood is immediately placed over the patient's face, the elastic purse-string stretching around the crown of the head and encircling the chin. This allows the saturated pad to fall close to the face of the patient. It should be lifted up immediately by being grasped through the rubber sheeting and held away a slight distance to lessen the pungency of the concentrated vapor.

ACTION OF THE MIXTURE.

The action of the mixture must now be remembered. The ethyl chlorid will first leave the uplifted pad, filling the space within the hood with its vapor. This is sufficiently potent to produce complete ethyl chlorid narcosis. As the ether vapor will not leave the uplifted pad in sufficient concentration to produce ether anesthesia before the effects of the ethyl chlorid have vanished, the pad is lowered so that the mixture is directly over the nose and mouth of the patient, forcing the patient to breathe through the saturated area, thereby drawing out the ether vapor in sufficient concentration and quantity to produce ether anesthesia before the patient emerges from the ethyl chlorid narcosis. The hood is left in this position throughout the induction or operation, the jaw of the patient being supported, if neccessary.

Although there is very little chloroform in the mixture, its presence is sufficient to prolong the ethyl chlorid effect until the ether has had time to act fully. Results with ethyl chlorid-ether mixtures without chloroform were not satisfactory and the mixture, herewith presented, contains the smallest quantity of chloroform commensurate with good results.

THE PATIENT'S RESPONSE.

The patient, at first, is apt to be frightened by the procedure, but not to any great extent. If he be directed to take *short* breaths he will experience no unpleasantness during the brief interval before unconsciousness supervenes. If his first breath is a long one the pungency of the mixture will be slightly disagreeable. The average stage of excitement is far shorter than that occurring with straight etherization. After a patient has once been anesthetized with the mixture there is no excitement stage during other administrations. Some patients have taken this form of anesthesia on as many as 15 consecutive days for painful dressings, without untoward effect. In most instances patients have insisted upon having this anesthesia for the subsequent dressings of their painful wounds.

Any effects, aside from those directly traceable to etherization itself, have been negligible. Patients, who had eaten within an hour preceding anesthesia, would frequently vomit.

ANESTHETIC POINTERS.

In the application of this rapid induction method of anesthesia for military surgery, it is the action of the ethyl chlorid content of the mixture that must be understood.

Ethyl chlorid, in overdose, produces either (a) pharyngolaryngeal spasm, which if the overdose be continued will proceed to respiratory obstruction or (b) a slower depression of respiration from the anesthetic effect on the central nervous system. Crowing inspiration is the warning of pharyngolaryngeal spasm, and fortunately its onset is gradual. The hood need not be removed at the earliest manifestations of this spasm as it often occurs with this method with the given dose of ethyl chlorid, but is of slight intensity. The patient showing such spasm *after consciousness is lost* should be watched and the hood removed if the spasm grows progressively deeper. The spasm, sometimes seen before consciousness is lost, is due to the pungency of the vapor, when the pad has not been lifted from the face quickly enough. It is of no consequence. The true ethyl chlorid spasm occurs only from overdose and is never manifested until after consciousness has been lost.

In this recorded series of some 2,000 administrations it was deemed necessary to remove the hood, on account of spasm, only on three occasions. In these three instances anesthesia was continued with straight ether.

Progressive depression of respiration, from the central effect of the anesthetic, is easily detected because of its progressive character and there is ample time for the removal of the hood and withdrawal of the anesthetic mixture before respiration ceases altogether. Respiration will cease most certainly if the overdose is continued. But as ethyl chlorid seems to have no effect on the cardio-

vascular system, even though depression should go on to complete cessation of respiration, there is no need for alarm. The condition may be likened to respiratory paralysis under ether, except that it is much less serious and can be more easily handled. Ethyl chlorid is so rapidly eliminated that from one to five movements of artificial respiration serve to carry the overdose away from the medulla and re-establish normal breathing.

In the 2,000 recorded administrations of this mixture it was deemed necessary to remove the hood and withdraw the anesthetic in two instances because of this depression of respiration. On no occasion did respiration cease completely. In my own experience I have not observed that spasm and depression occur in the same individual. Apparently they are different reactions and just why one patient should show spasm as a result of overdose and another respiratory depression, is still inexplicable. However the fact remain.

Also in my own observation one case of depression was noted to every ten cases of spasm. This ratio of untoward symptoms held good for the entire series.

These observations on the action of ethyl chlorid are based, not on the method of mixed induction anesthesia, as herewith described, but on studies of ethyl chlorid, *per se,* as a general anesthetic. The untoward symptoms are included, not because these symptoms are frequently noticed during induction, but simply to counteract the faulty impressions generally prevalent regarding the dangers of ethyl chlorid, due to lack of acquaintance with its action and effect. It is in no wise so treacherous nor toxic as chloroform.

FURTHER CONSIDERATIONS.

As already stated the anesthesia with this method is induced in the average time of 2 minutes or less and the initial application affords an available period of from 12 to 20 minutes of operative anesthesia.

In some cases the ventilator opening in the top of the hood is insufficient to prevent the cyanosis of rebreathing, in which instances the edge of the hood is lifted, from time to time, from the face to admit fresh air. Cyanosis is not at all necessary to the success of the method nor is it to be tolerated.

This method is a great time saver in inducing other anesthesia either by the open-drop or semi-closed method of administration. Two minutes after the hood is supplied the operation may be started. The hood is preferably removed in from 6 to 8 minutes for the change to straight ether. At this time the narcosis from the rapid induction mixture is deepest.

It is necessary to watch the patient closely for the first 3 minutes following the application of the hood, as it is during this period that the ethyl chlorid in the mixture is active. After 3 minutes the effect of this agent is negligible and the patient is practically subject only to straight ether anesthesia by the closed method.

If the pad is not raised immediately after the hood is applied, there will be some breath holding, and if the patient takes a long, deep breath at first, even if the pad has been raised, breath holding may also result.

If the pad is not lowered to the face as soon as the ethyl chlorid narcosis supervenes bringing a concentrated ether vapor into effect, the potency of the ethyl chlorid may vanish while the patient is in the excitement stage of etherization, in which case there may be some resistance and struggling.

Owing to the exigencies of circumstances the anesthesias upon which this report is based, were given in the rush of war surgery, during periods of intense activity, mostly by nurses and hospital orderlies, who had had no previous training in anesthesia. They were working under my direct supervision.

3902 N. CAPITOL AVE.

THE ADMINISTRATION OF ANESTHETICS TO SOLDIERS—AN ETHYL CHLORID-ETHER VAPOR METHOD.

ARTHUR MILLS, M.D.

Temp. Captain Royal Army Medical Corps; Lecturer in Anesthetics, University of St. Andrews.

Since the beginning of the war I have had considerable experience in the administration of anesthetics to soldiers in this country—in the first instance, to soldiers in a war hospital suffering from wounds and invalided home from the fronts, and latterly to young soldiers in full training admitted to a camp military hospital to undergo some operation. The two classes really differ considerably as regards type. The large majority of the former have been confined to bed for at least a few days, and are *invalids,* and differ very little, as regards my subject, from the usual type of hospital patient in civil life. At the camp military hospital, on the other hand, we are constantly meeting with the young, athletic, well developed man of 18 to 21 years of age engaged in a period of intensive physical training. Frequently the operation is a trivial one, and admission to hospital the day previous to the operation is considered sufficient for the purposes of preoperative preparation. The nervous system of the young soldier is by no means stable. He is frequently far more *nervous* than a woman. His reflexes are exquisitely sensitive. He is in hard muscular condition. He is nearly always a heavy cigarette smoker. We have thus many factors which go to make up a type difficult to anesthetize safely and satisfactorily.

It must at once be laid down in the most emphatic manner that for such cases induction of anesthesia with chloroform is strongly contraindicated. Should the attempt be made to anesthetize with chloroform, it will be found

(*Continued on page* 62.)

American Journal of Surgery

QUARTERLY SUPPLEMENT *of* ANESTHESIA *and* ANALGESIA

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Avon Lake, Ohio, U.S.A.

APRIL EDITORIALS. 1919

THE IMPORTANCE OF BLOOD PRESSURE OBSERVATIONS IN SURGICAL PROGNOSIS.

Speaking before the Providence Medical Association, Albert H. Miller, the noted anesthetist, again emphasized the fact that the blood pressure is the most valuable single means at our disposal for making a preoperative prognosis and for judging the condition of the patient during and after operation. It may uncover arterio-sclerosis, nephritis, myocarditis, aortic insufficiency, or mitral stenosis. It registers the ability to withstand hemorrhage, the depression of the anesthetic and surgical shock.

In his reprint from the *Boston Medical and Surgical Journal*, January 2, 1919, Miller contends that, in the present advanced state of surgical knowledge, the patient has a right to expect a fairly exact preoperative diagnosis and a very exact preoperative prognosis. The surgeon who makes and records a prognosis before each operation and checks up his preoperative opinion with the result will rapidly gain in skill in this important department.

Miller classifies his cases into good, fair and poor risks. Good risks,—patients free from organic disease, whose surgical condition is not likely to prove fatal,—are expected to recover. If a fatality occurs in this class of patients, the case should be carefully gone over to determine if the preoperative prognosis was in error or the work of the surgical team to blame for the fatality. In fair risks,—patients suffering from organic disease, but whose surgical condition is not specially serious, if no examination and no prognosis has been made, the necessity for a lame explanation of a fatality,—for instance fatal diabetic coma after appendectomy,—is most deplorable. In poor risks,—patients whose surgical condition is so serious or so far advanced as likely to result in fatality, recovery may be unlikely without operation, and the prospect of death should be anticipated by due warning.

In a series of 1,000 consecutive operations, studied under this classification, Miller found the following results:

	Class 1	Class 2	Class 3	Total
Cases	734	179	87	1000
Deaths	2	14	29	45
Percentage	.27	7.82	33.33	4.5

The deaths recorded occurred in from 24 hours to 3 weeks after operation. No deaths took place during or immediately following operation. Measured method of anesthesia were used by Miller exclusively.

To determine the accuracy of Moots' rule:—that if the pressure ratio (representing the relationship existing between the kinetic energy expended by the cardiac contraction in moving the blood column and the potential energy stored in the arterial walls and columns of blood which they contain), lies between 25 and 75 per cent., the case is probably operable, if outside these limits, probably inoperable,—Miller investigated his series of 1,000 cases and tabulated the results. According to Moots' rule 3.23 per cent. of the operable cases died and 96.77 per cent. recovered. Of the inoperable cases 23.07 per cent. died and 76.93 per cent. recovered. Some of the cases classed as inoperable underwent minor operations safely, and some of those classed as operable died after very serious operations and under circumstances which could not have been readily predicted. On an average, Miller believes that his results show the great value of Moots' rule in surgical prognosis.

McKesson's rule:—that after a half-hour of sustained low blood pressure and rapid pulse, almost every patient succumbs either shortly or within three days of surgical shock and heart exhaustion,—was put to a similar test. In a considerable number of cases shock (characterized by a diastolic pressure of 80 mm. or less, a pulse pressure of 20 mm. or less and a pulse rate of 120 or more), was reported by Miller to his surgeons and the operation rapidly completed. All of these patients

recovered. Thirteen of the patients were in the danger zone for from 25 to 70 minutes. Of these 9 died, giving a mortality rate of 69.23 per cent. These figures certainly indicate the efficiency and great value of McKesson's rule for determining shock during operation.

Both rules, according to Miller's conclusions, are trustworthy and valuable aids and should be routinely employed.—McM.

ANESTHESIA AT THE FRONT

(*Continued from page 60.*)

that the large majority of these men develop excitement and struggling and spasm of the limbs and respiratory muscles. If at the moment of onset of such a state of spasm a strong chloroform vapor has been inhaled, it may be retained in the pulmonary alveoli for a considerable time, the percentage of chloroform in the circulating blood may be raised to a toxic degree, and fatal symptoms may appear while the corneæ are still sensitive. The heart, indeed, gives way before breathing can be reestablished.

It is exceedingly doubtful, too, whether a mixture of chloroform and ether is safer than pure chloroform during the induction period. The difference in degree of volatility of the two substances forms the difficulty. If any anesthetic effect whatever is to be obtained from the ether element in the mixture, measures must be adopted to exclude the air to some extent, and exclusion of air is not permissible if the chloroform element be present in any degree. Again, if the mixture be administered by anything resembling the constant drop method, or if the successive *doses* poured on the mask be too frequently repeated, we must remember that the proportion of chloroform in the vapor inhaled by the patient is rising to an unknown extent. My experience, indeed, goes to show that the result obtained by induction with a chloroform and ether mixture is the same as that obtained with pure chloroform.

Induction with pure ether, again, is attended in these cases with considerable difficulty. A large proportion of them have a certain degree of pharyngitis from excessive cigarette smoking, and coughing and choking are common phenomena.

Nitrous oxid gas produces too light and evanescent an anesthesia in these robust subjects to form a satisfactory prelude to ether, and any attempt to prolong it by administering more gas results in undesirable cyanosis.

I have come to the conclusion, therefore, that an ethyl chlorid-ether sequence is the best method we can adopt for induction, and have devised a method of using this sequence which I should like to bring to the notice of others.

I do not think that the majority of administrators use ethyl chlorid in the most satisfactory manner. Although we quite realize that it is not the quantity of anesthetic used but strength of vapor inhaled, that is the determining factor in producing anesthesia, I find that in books on the subject, such as Hewitt's and Buxton's, this principle is fully realized when discussing chloroform or ether, but it is thrown aside when treating upon ethyl chlorid. We are told, for example, to give so many cubic centimeters to a child and so many to an adult. This method would be all right so far if we could be sure that the quantity of ethyl chlorid prescribed could always be vaporized in a desired and known quantity of air. We cannot be sure of this. Again, it is impressed upon us in administering chloroform and ether that the patient should be *gradually* put under with a steadily increasing strength of vapor. With the recognized methods of giving ethyl chlorid, on the other hand, there is nothing to prevent the patient getting the full strength of the vapor with his first inhalation, a really dreadful experience for the patient, and associated with considerable danger. For the past five or six years I have constantly used an inhaler for ethyl chlorid devised by Mr. C. J. Loosley, anesthetist, Hospital for Children, Great Ormond Street, and have given many hundreds of administrations, including about 300 to soldiers (early in the war) undergoing dental extractions. To have a stopcock fitted to the foot of the bag and this connected by rubber tubing with an ether bottle and bellows was an easy matter, and this forms the simple apparatus which I now use in giving the ethyl chlorid-ether vapor sequence.

To indicate briefly how the apparatus is used, and quoting freely from Mr. Loosley's description of his inhaler, about 3 c.cm. of ethyl chlorid are sprayed into the bag through the valve. This valve opens when the nozzle of the ethyl chlorid tube is pressed against it, and closes automatically immediately the nozzle is withdrawn, a tube below carrying the discharge well away from the face-piece. The face-piece is applied to the patient's face and the lever of the two-way cock kept in the down position so that the first few breaths of the patient are turned into the bag till it is about half full. The lever is now pulled upwards towards the face-piece and the patient breathes a dilute mixture of ethyl chlorid vapor and air. Dilute ethyl chlorid vapor is quite pleasant to breathe. A vapor sufficiently strong to produce anesthesia is pungent and produces a sense of suffocation. The vapor is now strengthened by spraying a little more ethyl chlorid through the valve, and still a little more until anesthesia is produced. The patient is now, as a rule, breathing vigorously, but there is abundance of air in the bag and he can take a full breath without emptying it.

Using ethyl chlorid alone we can safely push the anesthetic till we have the usual signs, fixed eyeballs, dilated pupils, and insensitive corneæ—before removing the face-piece, and a good minute and a half or more of satisfactory anesthesia without trace of cyanosis will be obtained. Using it in sequence with ether a profound ethyl chlorid effect is not desirable, and as soon as unconsciousness is produced ether vapor may be pumped into the bag by means of the hand bellows. The strength of ether vapor can be varied within any limits by varying the degree of vigor of pumping and by the admission of more or less air at the face-piece. The apparatus is very economical as regards amount of ether used, a certain amount of rebreathing being involved, and, if desired, a much stronger vapor can be obtained than by using a Clover.

I contend that the method is a safe and highly satisfactory one for the induction of anesthesia, especially for the difficult type of patient under consideration, and it is also a satisfactory apparatus to use in maintaining anesthesia in the large majority of operations in a camp hospital.

I think that most administrators will agree that quick inductions and closed inhalers tend to be associated with vigorous respiratory movements. In abdominal cases I therefore prefer a slow induction with chloroform and an open mask, changing to ether and an ether mask and the drop method before the dangerous period of excitement supervenes. Fortunately abdominal cases rarely come to operation while yet in a state of youthful vigor, and thus do not present the difficulties I have been discussing. In conclusion, I am convinced that the previous hypodermic administration of 1-6 gr. morphin and 1-100 gr. atropine is of considerable value. The hypodermic should be given no matter how trivial the operation may be.

Occasionally the nature of the operation demands the use of chloroform, but after the induction period is over and full narcosis has been produced these young soldiers take chloroform well.

THE AMERICAN ASSOCIATION OF ANESTHETISTS WILL HOLD ITS SEVENTH ANNUAL MEETING IN ATLANTIC CITY, N. J., JUNE 9-10, THE FIRST TWO DAYS OF A. M. A. WEEK. LIEUT. COMMANDER WM. SEAMAN BAINBRIDGE, M.C., U. S. N., WILL SPEAK AT THE ANNUAL DINNER OF "SOME SURGICAL LESSONS OF THE WAR," AND ILLUSTRATE HIS TALK WITH SLIDES AND FILMS TAKEN IN THE SERVICE.

THE FIELD OF LOCAL ANESTHESIA IN A WAR HOSPITAL.

LOUIS J. HIRSCHMAN, Major M.C., U.S.A.
DETROIT, MICHIGAN.

Among the many interesting surgical methods revived and elaborated through the stress of military needs, the employment of local anesthesia has been of great value in the surgery performed in a military hospital.

Base Hospital 17, Harper Hospital unit of Detroit, was located in a city of 130,000 inhabitants. This city was a great railroad center and was on the direct line traversed by many of the American Expeditionary Forces in going to and from the front. Many thousand troops were encamped in the vicinity of this hospital, and among those freshly arrived from the U. S. A., it was not all infrequent to find cases of hernia, rectal diseases, abscesses and other conditions met with in civil practice. The prevalence of coughs, colds and pulmonary diseases in France, and the susceptibility of the freshly arrived American troops to the same, made the employment of general anesthesia impossible in many cases requiring surgical measures for their relief.

For years the writer has been employing local anesthesia in the treatment of diseases of the rectum and anus, as well as in the radical treatment of hernia. On account of its many manifest advantages over general anesthesia, it had been used in suitable cases as the anesthetic of choice in civil practice. In a war hospital where expedition in the handling of surgical cases, minimized hospital confinement, and early return to duty were of prime importance, anything which would hasten the desired ends, was of distinct benefit. Added to this was the prevention of the great danger of post-anesthetic complications, involving the lungs and kidneys, as well as the fact that on account of the absence of post-operative vomiting, the patient's nutrition could be built up so much sooner. Another important advantage is the fact that the anesthetist can be dispensed with. This releases a medical officer for other more important duties. An operation under local anesthesia can be performed more rapidly than in the time allowed for the administering of a general anesthetic and of performing an operation together. This meant more surgical operations could be performed in the same length of time.

In addition to the surgical procedures mentioned above, many operations on the scalp and skull, rib resections, amputations of fingers, and secondary suture of wounds of considerable extent, excision of infected wounds, operations for phimosis, varicocele and bubo were performed readily under local anesthesia.

In the author's surgical service, the average time required for an operation for inguinal hernia was seldom over twenty-five minutes. Five or six rectal operations were performed in one hour and the average secondary suture required about the same time. Rib resections were completed in fifteen minutes and colostomies and the operation for appendicular abscess were performed in fifteen minutes.

The employment of a hypnotic before operations under local anesthesia is of prime importance. The administration of twenty grains of chloretone one hour before operating, or of a quarter or third of a grain of morphine one-half hour before operating was the author's usual practice.

The patient would come to the operating room in a quiet tranquil frame of mind. His ears were muffled with cotton and a towel placed over his eyes and all unnecessary noises and conversation eliminated. If however, a patient wished to converse with the operator, he was allowed to do so, and oftentimes the operation took on more of the character of a social visit, than that of a surgical procedure. Patients would leave the operating room smoking cigarettes and would go back to their wards cheering up the patients who were to follow.

The absence of after-pain was a very pleasant feature of the employment of local anesthesia. The solution used was one quarter of one per cent. novocain to each ounce of which was added six drops of solution of adrenalin chlorid. It is of the greatest importance to use sufficient solution to secure pressure anesthesia and important nerves such as the ilioinguinal in hernia should be well blocked by perineural infiltration.

Any of the operative measures used under general anesthesia in the treatment of hernia can be just as well employed under local. The average time required for the hospitalization of a hernia case where local anesthesia was employed in its cure was reduced one week. The value of this saving of time in military life is of great importance and in civil life, it should be equally so.

Sepsis was practically unheard of, in fact did not occur as often as in cases operated under general anesthetic, which the author believes is due to the fact that there is less handling of the tissues under local than under general anesthesia.

In rectal surgery, it is unnecessary to dilate the sphincter. The employment of local anesthesia by its relaxation of the sphincter allows a better field for operative measures than the divulsed and damaged sphincter of the old regime.

Moreover the patient in most of the cases is allowed to be up and about after the first twenty-four hours. Convalescence and an early return to military duty is hastened. Patients after most operations performed under local anesthesia, seem to vie with one another in the speed with which they could be returned to duty.

In the surgical treatment of war casualties, the removal of foreign bodies, such as machine-gun bullets and shell fragments was very easily accomplished. The most suitable cases were those in which localization by the *x*-ray demonstrated the presence of foreign bodies in the soft structures and not embedded in bone.

Suturing of lacerated wounds, particularly of the scalp was a very favorable operation under local anesthesia. Debridement, or the excision of devitalized tissue in a wound, could be done surprisingly well, provided the wound was not too extensive or involved too much muscle. Secondary suture of superficial wounds was an ideal procedure under local anesthesia.

To recapitulate, any operative procedure which can be done just as thoroughly under local anesthesia as under general anesthesia, should be performed for the following reasons:

1. It is safer.
2. It can be performed more rapidly.
3. Shock is absent.
4. Fewer assistants are required.
5. After-pain is absent.
6. Patients can take nourishment immediately.
7. Recovery is hastened.
8. Convalescence is shortened.
9. There is no fear of anesthesia.
10. Less handling of the tissues means less danger from sepsis.
11. The mental attitude is better toward local than general anesthesia, which materially assists in his convalescence, and in a ward is reflected on his fellow patients.
12. Post anesthetic complications are absent.

1016 Kresge Building.

Book Reviews

Scopolamine-Morphine Semi-Narcosis During Labor. By WM. OSBORNE GREENWOOD, M. D. (Leeds), B. S. (Lond). Small Octavo, pp. 120, Cloth Bound. OXFORD MEDICAL PRESS, Publishers, New York City, 1918.

Greenwood admits that the subject of his monograph has been violently condemned by some and just as enthusiastically eulogized by others. Unfortunately the earlier experiments with alkaloidal amnesia and semi-narcosis were admittedly haphazard and it would have been remarkable if the results had not been as various as the different methods of using the drugs. Some allowance must also be made for the impurities present in earlier preparations of scopolamine.

This permanent form of Greenwood's experiences resulted from requests from many fellow-practitioners for full details of his technic. The monograph is based on the available literature of the subject and Greenwood's extended experience with the method, and patient individual study.

After summarizing the historical evolution of semi-narcosis, Greenwood discusses the chemistry and action of the alkaloidal amnesics and the objects of this particular method of obstetrical pain-relief. His recommendations regarding the technic of administration are detailed and helpful. He considers the effects on the mother and child and evaluates the results obtained, basing his conclusions on accurately kept charts. He believes that semi-narcosis has a beneficial effect on the birth-rate.

The volume closes with an interesting note on a new amnesic combination "Scop-omnopon," and a valuable bibliography.

Society Proceedings

Membership in a society devoted to your specialty is an essential to success.

AMERICAN ASSOCIATION OF ANESTHETISTS SEVENTH ANNUAL MEETING.

The American Association of Anesthetists will hold its Seventh Annual Meeting in Atlantic City at the Breakers' Hotel, June 9-10, 1919, the first two days of A. M. A. week.

Among the interesting and instructive papers to be presented may be mentioned the following:

Studies in Surgical Acidosis, Yandell Henderson, Yale University Medical School; Reactions of the Nephropathic Kidney Under Anesthesia, Wm. deB. MacNider, University of North Carolina; The Acid-Base Regulatory Mechanism during Anesthesia, S. P. Reimann, Philadelphia, Pa.; Experimental Surgical Shock, F. C. Mann, Mayo Clinic; Treatment of Traumatic Shock, Fenton B. Turck, New York City; Physiology and Physics in Relation to Anesthesia, Wm. B. Howell, Montreal, Canada; Heart Lesions in Anesthesia, F. L. Richardson, Boston, Mass.; Some Advantages of the Sitting Posture in Operations on the Nose and Throat, F. D. Sanger and Griffith Davis, Baltimore, Md.; A Simple Method of Administering Ether with Oxygen and its Advantages, Jos. E. Lumbard, New York City; Some Observations on Open Ether, Robt. H. Ferguson, East Orange, N. J.; A New Method of Etherization, A. H. Miller, Providence, R. I.; Some Observations on Intratracheal Anesthesia in Neurological Surgery, A. W. Adson, Rochester, Minn.; Experiences with Anesthesia in Thoracic Surgery in the War Zone, Howard Lilienthal, New York City and other papers on Anesthesia in War Surgery, not yet definitely scheduled on account of the uncertainties of demobilization.

The Annual Dinner will be served at The Breakers, Monday evening, June 9, at 6:30 o'clock at $3.00 a cover. The principal speaker of the occasion will be Wm. S. Bainbridge of New York City, who will talk on Some Experiences of a Naval Surgeon in the War and illustrate his remarks with slides and films.

As a large attendance is expected those who expect to be at the meeting should make their reservations in advance. The Breakers, Boardwalk and New Jersey Ave., will house all the activities of the Seventh Annual Meeting, and will provide accommodations on either the European or American plan as desired.

For further particulars address F. H. McMechan, M.D., Secretary, Avon Lake, Ohio, R. F. D.

Quarterly Index

ANESTHESIA, DECREASED PLASMA BICARBONATE DURING AND ITS CAUSE. PLASMA CARBON DIOXID, BLOOD AND URINE KETONE AND BLOOD CATALASE ANALYSES IN OPERATIVE PATIENTS. S. P. Reimann and G. H. Bloom, Philadelphia. Journal of Biological Chemistry, October, 1918.

ANESTHESIA FOR WOUNDS OF CHEST. TREATMENT OF INFECTED HEMOTHORAX. W. Hutchinson. Journal Canadian Medical Association, November, 1918.

ANESTHESIA, GENERAL AND THE CIRCULATORY APPARATUS. L. Binet. Presse Medicale, December 19, 1918, Vol. xxvi, No. 70.

ANESTHETIC, RECENT WORK IN. J. Blomfield, London. The Practitioner, November, 1918.

BLOOD PRESSURE OBSERVATIONS, THE IMPORTANCE OF IN SURGICAL PROGNOSIS. Albert H. Miller, Providence, R. I. Boston Medical & Surgical Journal, January 2, 1919.

CHLOROFORM, ACTION OF, ON LIVER AND DISTURBANCES FROM. D. Lobo and others. Graceta Medica de Caracas, Venezuela. August 31, 1918, Vol. 44, No. 7.

CHLOROFORM, EFFECTS ON THE HEART. E. Fernandez. Graceta Medica de Caracas, October 15, 1918, Vol. xxv, No. 19.

CHLOROFORM, MECHANISM OF THE ACTION OF. V. Aloi. Riforma Medica, November 9, 1918, Vol. 34, No. 45.

DEATHS—COCAIN POISONING. REPORT OF CASE WITH NECROSCOPY. E. Kellert. Journal Laboratory & Clinical Medicine, December, 1918.

DEATHS—FATAL COCAIN POISONING. W. Moller. Ugerkrift for Laeger, Copenhagen, October 31, 1918, Vol. 80, No. 44.

ELECTROLYTIC ANESTHESIA IN MEDICO-ODONTOLOGICAL PRACTICE. Theodore A. Irigoyen, San Sabastian, Spain. La Odontologia, November, 1918.

ETHER ANESTHESIA, INFLUENCE OF HEMORRHAGE ON AND OF PLETHORA FROM TRANSFUSION ON PRESSOR EFFECTS OF MINUTE QUANTITIES OF EPINEPHRIN. P. Rous and G. W. Wilson. Journal Experimental Medicine, February, 1919.

ETHER ANESTHESIA FOR FACE AND JAW SURGERY. J. C. Clayton. Lancet, October 5, 1918.

ETHER DRESSINGS. P. Descomps and A. Richard. Paris Medical, September 21. Vol. 8, No. 38.

ETHER—OIL COLONIC ANESTHESIA. R. Monod. Presse Medicale, November 28, 1918.

LOCAL ANESTHESIA, FIELD OF, IN A WAR HOSPITAL. L. J. Hirschman, Detroit. Michigan State Medical Society Journal, January, 1919.

LOCAL ANESTHESIA, KIDNEY OPERATIONS UNDER. R. E. Farr, Minneapolis. Urologic & Cutaneous Review, February, 1919.

LOCAL ANESTHESIA. MASTOIDECTOMIES UNDER. C. T. Porter, Camp Upton, Yaphank, L. I. Journal American Medical Association, February 22, 1919.

LOCAL ANESTHESIA. CESARIAN SECTION UNDER. W. H. Brown. American Journal of Obstetrics, December, 1918.

LOCAL ANESTHESIA AND TWILIGHT SLEEP IN THE SURGERY OF EXOPTHALMIC GOITER. S. H. Rouquette. Lancet, December 7, 1918.

LOCAL AND REGIONAL ANESTHESIA. C. W. Allen. New Orleans. Dublin Medical Journal, January 1919.

LOCAL ANESTHETICS, THE NEWER. Raphael Vega Varrera, Lugo, Spain. La Odontologia, November, 1918.

LOCAL ANESTHETICS, COMPARATIVE VALUE OF SOME. H. C. Hamilton. Journal Laboratory & Clinical Medicine, November, 1918.

NITROUS OXID IN LABOR. L. C. Redmond, Lexington, Ky. Kentucky Medical Journal, November, 1918.

NITROUS OXID-OXYGEN IN COMBINATION WITH ETHER OR C-E MIXTURE FOR NOSE AND THROAT OPERATIONS. H. E. G. Boyle, London. British Medical Journal, December 21, 1918.

PAINLESS CHILDBIRTH AND SAFE CONDUCT OF LABOR. H. Schwarz. American Journal of Obstetrics, January, 1919.

SHOCK, EXPERIMENTAL SURGICAL. F. C. Mann, Rochester, Minn. American Journal of Physiology, November, 1918.

SHOCK, SURGICAL, TREATMENT OF IN WAR INJURIES. J. B. Roberts. Pennsylvania Medical Journal, December, 1918.

SPINAL ANESTHESIA. H. P. Achard. Progress Medical, August 31, 1918.

SPINAL ANESTHESIA. G. Palacios. Semena Medica, Buenos Aires, September 19, 1918, Vol. xxv, No. 38.

SPINAL ANESTHESIA, PRESENT STATUS OF. L. Razatti. Graceta Medica de Caracas, Venezuela, August 31, 1918, Vol. 44, No. 7.

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[American Journal of Anesthesia and Analgesia]

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July, 1919

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SOME OBSERVATIONS ON ANESTHESIA AS A SPECIALTY AND THE ANESTHETIST AS A SPECIALIST.*

A. S. McCORMICK, M.D.
AKRON, OHIO.

The word anesthesia was coined November 21, 1846, by the poet Oliver Wendell Holmes (Boston, 1809-94), who prefixed *an* to the Greek *aisthanomi*, —creating the new word meaning *inability to feel.*

Anesthesia and the bass drum have much in common. Any Tom, Dick or Harry can pound a drum but only the trained drummer can play it. Any one can pour or drop ether on a mask, according to the ideas of the majority of physicians, but how many have had proper instruction in anesthesia which is obtainable only from expert specialists and not during an internship. The average intern gives anesthetics because compelled to, not because he wishes to. He is usually more interested in the technic of the operation and cares nothing about anesthetic or patient. W. D. Gatch of Indianapolis, says, "only rarely does an internship give proper training." P. J. Flagg, of New York, condemns the slip-shod custom of entrusting anesthetics to the junior intern. The arrival of the new man is, in some hospitals, followed by a series of deaths, upon the table, of unfortunates entrusted to his ignorance. Any hospital that depends on haphazard anesthetics given by the tired, untrained nurse or overworked, uninterested intern cannot have expert anesthesia or a low death rate. F. W. Pinneo, of Newark, N. J., describes interns, who while good technicians, betray, when questioned, ignorance of the theory and important facts of anesthesia. Yet it is a lamentable fact that some large hospitals have no visiting anesthetist on their staffs.

No specialty has met such unreasonable, narrow, undeserved opposition as anesthesia. Until recent years, the anesthetic was considered of no importance and any one and every one capable of giving it. It was supposed that the anesthetic did the work. Now we know better. Almost every physician fondly considers himself as skillful as the greatest specialist, even though he give but 12 anesthetics per year, whereas the latter may give that many and more every week. With too many of the profession the desire for the fee outweighs any consideration of their ability, the welfare of the patient or preference of the surgeon. The idea that there is anything more to learn than dropping or pouring ether or chloroform or a mask appears to them so preposterous that they will neither learn nor reconcile themselves to the fact that anesthesia, as a specialty, is as important as any other branch of the practice of medicine.

Another hindrance to progress is the attitude of many surgeons. Some are indifferent to everything but the operation (or fee) and care nothing about the condition. The chances or comfort of the patient, or the mentality and capacity of the anesthetist. Others prefer the expert but lack the courage to insist upon his use for fear of offending the man who refers the case,—often one whose anesthetic methods are so bungling and crude as to worry the surgeon from start to finish, cause him to hurry and sometimes find to his mortification a piece of tonsil remaining or the uvula amputated or incomplete closure of the abdomen followed by hernia and the condemnation of the patient. General practitioners often say: "I give an anesthetic in fear and trembling. If anything unusual occurs I don't know where I'm at." The obvious inference is: "Why do you and what moral right have you to give anesthetics?"

When an operation is required would it not be wise for the physician to ask himself: "What would I want for myself or family? Should I be willing to trust my life to anyone or would I want the best expert obtainable?" As G. W. Kennedy, of Sharon, Pa., says, "People now ask, 'who is to give me the anesthetic?'" They fear anesthesia, not the operation, and their usual request is: "Don't give me too much, but be sure I'm asleep." The expert knows the why and wherefore of anesthesia and where he is at. The general practitioner does not. N. Senn, now deceased, said: "Very few physicians are safe anesthetists. An anesthetic is comparatively safe in the hands of an expert but a dangerous weapon is left to the inexperienced." E. R. Kemp, of Knoxville, Tenn., says: "No anesthetic can overcome lack of skill and judgment or carelessness and ignorance."

By constant team work the anesthetists learns the methods, ability, characteristics of the operator and how to deal with them. The latter learns to depend on his anesthetist and is relieved of all worry. If not able to insist upon a skilled anesthetist for all his operations he should at least have sufficient backbone to do so, for all dangerous work or cases requiring more than ordinary care and skill. Unless surgeons properly support and encourage the experts they cannot expect more than a very few physicians to devote their time to anesthesia. If they will demand the expert anesthetist

*Read during the Fourth Annual Meeting of the Interstate Association of Anesthetists, in conjunction with the Indiana State Medical Association, Hotel Claypool, Indianapolis, Ind., Sept. 25-27, 1918.

and permit the man in charge of the case to otherwise assist, there will be less desire on the part of Tom, Dick and Harry to give the anesthetic.

Swearing at or bullying nurses is impolite, unnecessary, and rude. Howling at the anesthetist is similarly out of place. If the latter be having trouble he will do his best. Encouragement and sympathy will help him and the patient more than vulgar bawling or cursing. In the words of W. S. Chase, of Akron, Ohio, "Swearing should be indulged in only when necessary for the success of the operation." The surgeon has yet to live who can supervise the anesthetic and operate at the same time.

Physicians don't care to patronize a surgeon who continually "butts in" on the anesthetist's work. The man who "butts in" usually bungles and fumbles and does more harm than good. For the operator to dictate to the anesthetist is no more proper than for the latter to direct the operation. The surgeon should remember that the anesthetist is not a servant but an highly trained and skilled specialist whose knowledge of anesthesia far surpasses his own. Let him therefore exhibit the same courtesy and patience toward the anesthetist as the latter does toward him. If he be unable to refrain from interfering, day after day, he may find a nurse anesthetist cheaper financially and more likely to submit tamely to his whims and eccentricities. J. A. Zabrocki, of Chicago, says, "The nurse anesthetist has proved practical mechanically, but scientifically lacking and dangerous." A. A. Freiberg, of Cincinnati, Ohio, says, "The science of anesthesia depends on physicians for its future development."

A. D. Bevan, of Chicago, adds: "No matter how well trained, she (the nurse) is not prepared to give instruction nor to add to the existing knowledge of the science by properly conducted research." In all its history, no nurse has contributed anything of value to the science or art of anesthesia and, it is likely, never will. The nurse will always remain a nurse.

It is the moral duty of the surgeon to protect the anesthetist from loss by compelling prompt payment of his fee. The patient will cheerfully obey his doctor if he insist on cash before or immediately after operation for the anesthetic. The patronage of a surgeon whose patients are chiefly paupers and dead beats and who operates on anything and everything in order to get a job or add to his statistics is of no value and is better avoided.

The plea of a *dead beat or cheapskate*: "I didn't engage you," as an excuse for not paying is of no avail in law. On April 7, 1916, Justice C. W. Dickerson, of Akron, Ohio, condemned one of this type to pay my fee and court costs. Other cases kindly furnished by the A. M. A. Law Department are 64 Conn. 432, 40 Iowa 84, 47 Iowa 625, N. Y. 138, N. Y. 1072, N. Y. 139, N. Y. 934, 67 Wis. 572. In every case the law decided that if an assistant be required the physician in charge may engage him. The patient whether consulted or not is legally responsible for payment of the assistants. While some few surgeons have contributed valuable knowledge to anesthesia, only rarely is a surgeon an expert anesthetist. Equally rare is the surgeon who does not believe he is one, an anesthetist. G. W. Crile, of Cleveland, frankly admits that he dare not give an anesthetic. J. T. Gwathney, of New York City, says: "It is almost impossible for a surgeon to keep up with the literature of his own specialty. That he is not up-to-date on anesthesia is proved by the type of anesthetics witnessed in some of our best known clinics." It is nevertheless possible to learn much about team-work from a co-operative surgeon; but proper instruction in anesthesia is obtainable only from expert anesthetists.

The greatest advances in anesthesia have been effected by the men who have devoted themselves to its art and science. Surgeons, coming to operation, say that if compelled to choose between poor anesthetist and good surgeon on the one hand and poor surgeon and good anesthetist on the other, they would choose the latter combination. They are willing to take chances with a surgeon but are very particular about the anesthetist. F. V. Dunderman, of Akron, Ohio, illustrated this by saying: "I know of ten men here who could take out my appendix, but only two who may give me an anesthetic." In Great Britain and Canada the status of the anesthetist has been long established. In the U. S. A. anesthetists are compelling recognition and raising the standard of their specialty. In real medical educational centres anesthesia has come into its own and surgeons demand the expert. In other cities recognition comes more slowly yet no less surely and the anesthetist and his science will compel it in spite of opposition which is nearly always that of envy or the prejudice of ignorance.

To be a real expert the anesthetist must limit his work to the specialty and devote all his time to study, experiment, and practice. He must be cool, patient, careful, systematic, fearless, especially the last, so that he will not do anything merely because this or that person thinks he should. He knows best what is required. When an operator becomes

rattled under a nervous strain the anesthetist's cool head and courage will be required. The anesthetist should be consulted about the preparation of the patient. He should meet the patient as early as possible, examine heart, lungs, nose, throat and gain the confidence of both patient and relatives. The latter may annoy you, but if ever your wife or child undergo even a simple operation you will realize the words of L. E. Brown, of Akron, Ohio, that, "It isn't so damn funny after all." Flagg condemns the indifferent or bullying manner of the average intern. This fault is inexcusable and a disgrace to any hospital permitting it. Examination of the throat is important, because as D. W. Stevenson of Akron, Ohio, warns, a latent diphtheria may be present and combined with the anesthetic is often fatal, and always dangerous.

If properly interested in his work the anesthetist will acquire skill in diagnosis and prognosis from even the appearance of the patient. It is possible to diagnose pus from the odor of the patient's breath and correctly in 90 per cent. of such cases.

The anesthetist should be equipped to give an anesthetic any time, anywhere, for anyone. His rule should be: promptness in keeping engagements; first call first served and unfailing cheerfulness and courtesy to all his patrons. He should uphold the honor and dignity of his specialty, especially among those "critics" who possessing none or little of his skill yet fondly imagine themselves his equal, even superior. Above all he should avoid criticism of operators and anesthetists, even the "knocker" who is suffering from colic caused by the unripe fruit of the grapevine. He should keep out of the infernal, eternal wrangling and scrapping of surgeons. He should be neat in appearance and dress and at all times the gentleman.

He should join at least one of the Associations of Anesthetists, and, of course, his local society and state or provincial and national associations and attend and be interested in their meetings. He should read every book bearing upon anesthesia, and its current literature in various journals. He shall read everything, judiciously, by remembering what is of value and forgetting the rest.

The lives of many persons of all ages will depend upon the anesthetist. My youngest patient was 7 days, my oldest 85 years. There are 4 causes of death:

1. Patient.
2. Operator.
3. Anesthetist.
4. Anesthetic.

Kemp says: "Patients will die after operations in spite of the anesthetic; but for some time to come it will be the scapegoat and compelled to bear the sins of others." Too many surgeons endeavor to conceal other and real causes of death by blaming the anesthetic or anesthetist. In order that the latter shall not be at fault he must never relax his attention to the patient's eyes, respiration, pulse, color, nor forget his responsibility.

Ethyl chlorid kills by causing asphyxia either from overdose (more commonly) or secondary to spasm of the respiratory tract. Death rate 1 to 1,100. Chloroform kills by first stopping respiration then causing sudden heart collapse. Death rate 1 to 3,000. Ether kills by causing respiratory failure. Death rate 1 to 10,000. Nitrous oxid kills by causing sudden heart failure, not by asphyxia as usually claimed. Death rate 1 to 600 or less according to Baldwin of Columbus.

The anesthetist must therefore be on the alert for danger signals. Nothing is so certain to catch him napping as talking, especially when some one is trying to be funny. The operation is a serious affair for patient and relatives. Why do so many men consider it an appropriate occasion for comedy? By minding his own business and taking no part in gossip and jokes the anesthetist will avoid blame if trouble occur.

All of which merely proves that the only proper and competent person to give anesthetics is the physician expert specialist.

845 ARDMORE AVE.

THE ANESTHETIST ON THE HOSPITAL STAFF.*

ISABELLA C. HERB, M.D.
CHICAGO, ILL.

In the commercial world every vocation and every line of industry in which there is danger to life the state law compells safety devices or the posting of danger signals to warn employes. The fact cannot be gainsaid that a large proportion of the anesthetic deaths are preventable and yet what are the precautions generally taken to safeguard the patient during narcosis? The saving of life in this respect demands the attention of the entire medical profession. The anesthetist who kills the patient through overdosage or the improper selection of the anesthetic can no longer hide behind heart disease or the status lymphaticus and in common vernacular get away with it, at least not with those who are prone to analyze results or cause and effects.

*Read during the Fourth Annual Meeting of the Interstate Association of Anesthetists with the Indiana State Medical Association, Claypool Hotel, Indianapolis, Ind., Sept. 25-27, 1918.

The slogan to be adopted, the safety device, is a single word, *education*. Every medical college should give theoretical and practical in struction in anesthetics and this course should be made compulsory, before a student is admitted to graduation. Fortified with such instruction the graduate who serves an internship in a well regulated hospital with a qualified anesthetist on its staff will be a distinct asset to the community, regardless of the branch of medicine, he may later elect to practice. Nothing can improve the status of the qualified anesthetist more than the education of physicians generally, in the subject of anesthesia. Gatch says: "Any art must suffer if it lacks an intelligent and appreciative clientele. By the extent to which anesthesia as a specialty, fails to command the support of the medical profession is to be measured the failure of the latter to appreciate the advantages of good anesthesia".

The public is surely learning the gravity of anesthesia in both its immediate and remote effects as is evidenced by the frequent question, "Who is going to give me the anesthetic?" or by engaging the anesthetist in the same manner as they engage the surgeon. When people generally understand that the life of the patient often rests with the anesthetist, better anesthetic service will be demanded and the administration of anesthetics will assume the importance and dignity it deserves. Fortunately the time is past when the most inefficient person present is chosen to administer the anesthetic. W. W. Keen, a surgeon of wide experience and international fame has pertinently said: "Next to the surgeon and even before his first assistant stands the anesthetist holding the scales of life and death."

Combine experience with an observant, analytical mentality and a clear judgment and the result is an efficient person whose opinion can be respected. The anesthetist who has the above qualifications and also possesses tact, sympathy and a reassuring personality is a definite asset not only to the surgical department but to the hospital that claims him as a member of its staff. The influence that such an individual exerts is unconsciously felt throughout the institution. It is passed from physicians to nurses, from nurses to patients and from patients to friends and the result is that a confidence is established before the patient goes to the operation room. Naturally the fear of the anesthetic is lessened if not altogether abolished.

RELATION OF THE ANESTHETIST TO THE SURGEON.

A perfect confidence, understanding and harmony should exist between the surgeon and anesthetist otherwise the best interests of the patient may be sacrificed. In all surgical risks it is a wise procedure for the surgeon and anesthetist to consider the case together. The surgeon explaining the surgical procedures he desires to institute, the physical condition of the patient and operative requirements can then be discussed and the selection of the anesthetic and the method of its administration determined. Of course this procedure can only be followed when qualified, experienced anesthetists are employed. What are the advantages to the surgeon in working with the specialist in anesthesia? The surgeon who has confidence in the judgement and ability of the anesthetist is relieved of all anxiety and worry as to the condition of the patient and his mind is free to engage in the surgical problem at hand. He is aware that the anesthetist is ever on the lookout for changes in respiration and circulation and will warn him of impending danger or approaching shock. The capable anesthetist, knowing the exact condition of the patient can intelligently guide the surgeon as to the advisability of added operative procedures. This so-called *teamwork* is responsible for better surgery and safer anesthesias both immediate and remote. Further the patient is made to feel that the surgeon has left nothing undone which will contribute to the success of the operation. It has been my experience that those surgeons who are most familiar with anesthetics, their action and the different methods of administration are the ones who are most willing to consult or be influenced by the qualified anesthetist. It is only just to assume that the physician who devotes all his time and study to this particular field of medicine should be better informed than the surgeon whose studies are along the line of surgery, consequently a qualified anesthetist is primarily a *consultant*.

RELATION OF THE ANESTHETIST TO THE INTERNES.

The value of supervision of the anesthetics given by the inexperienced internes can not be overestimated. He learns the method of handling patients with tact and courtesy and of allaying their fears and apprehensions thus obtaining their confidence and assurance of his ability. The instruction of internes should be directed toward the administration of anesthetics in such a manner that the occurrence of complications due directly to the anesthetic may be foreseen and prevented.

The beginner in the administration of anesthetics should be supervised in the same strict manner that he is in other branches of medicine and surgery. His college course does not fit him for anesthetic work any more than it fits him to perform opera-

tions or assume the care of a severely sick medical patient without supervision. The surgeon who relegates the administration of the anesthetic to the untrained junior interne without supervision is morally responsible for the outcome. It is just as reasonable to turn over the surgical patient and allow him to operate without guidance and expect him to do satisfactory work.

Internes enter hospitals in order that they may be taught to properly put in practice, under experienced supervision, what they have been taught theoretically in college. Just why surgeons should expect these men to be competent to administer anesthetics is as incomprehensible as that they are willing to risk the patient's life in their hands. Surgeons, in general, are too prone to let the adminstration of anesthetics be a matter of unthinking routine. Ignorance is not bliss when life is at stake. Danger must be recognized before it can be eliminated and the proper instruction of internes is not possible without qualified anesthetists on the staff. The proper teaching of anesthetics makes the administrator thoughtful, attentive and wary. It gives him confidence and wisdom under trying circumstances as well as a desire to seek more light the more he finds. The wish to acquire more knowledge and the finding of it brings joy in one's work and abolishes completely all thought of monotony or drudgery. The most successful teacher is he who can arouse the greatest amount of interest in the subject at hand. Flagg says: "The proper administration of an anesthetic is more than a mere mechanical performance, it is an art. To give an anesthetic is one thing, to practice the art of anesthesia is another." At the close of every interne's service he should be master of the principles of anesthesia and the different methods of producing and maintaining narcosis with a minimum of risk and a maximum of competance.

RELATION OF THE ANESTHETIST TO THE PATIENT.

The relation that the anesthetist bears to the patient is analogous to that of the surgeon. The life or future well-being of the individual may be jeopardized through carelessness or ignorance of the one or the other.

After the anesthetist is acquainted with the physical and mental condition of the patient, the operative requirements and preliminary preparation, the anesthetic to be given and the method of its administration can be determined. The attitude of the anesthetist toward the patient should be gentle and sympathetic. Mystery is disconcerting to most people consequently it is the better part of discretion to inform them why certain details such as the position on the operating table or covering the eyes is necessary. One of the greatest assets that an anesthetist can have is the ability to gain the confidence of his patients.

RELATION OF THE ANESTHETIST TO THE HOSPITAL.

The same confidence which exists between the surgeon and the anesthetist should exist between the hospital management and the anesthetist. It is the duty of the anesthetist to consider that a part of his duty is to help maintain a high-standard reputation for the hospital and to promote its interests by avoiding undue waste. It is desirable that he administer the anesthetic to all patients whose general condition makes the administration especially hazardous, as a large majority of these patients can be safely carried through a properly conducted anesthesia.

Only established methods of anesthesia should be employed or allowed. All experimental work should be confined to the lower animals and then sufficient time allowed to elapse for secondary effects to manifest themselves before the anesthetic or method is introduced into the hospital.

THE RELATION OF THE HOSPITAL TO THE ANESTHETIST.

The report of the Committee on Anesthesia of the American Medical Association (1912) was to the effect that: *"Every hospital, certainly every large hospital, should have as a regular member of its staff an attending anesthetist whose authority in his special branch should be as complete as that of the attending surgeons in theirs."*

The hospital that has not a medically qualified anesthetist on its staff is a menace to the best interests of the prospective patient and attending surgeon. What is meant by a qualified anesthetist? The qualified anesthetist is one who is capable of making a physical examination of the patient, can interpret laboratory findings, is familiar with operative requirements, able to weigh the evidence and select the most suitable anesthetic and the method of its administration for the particular patient under consideration. These qualifications require not only a medical education but special training in the theory and practice of anesthesia as complete as is demanded in the field of surgery or its correlated specialties. The tyro who gives an occasional anesthetic or the medical man who gives a few anesthetics to help pay expenses should not be considered qualified. It may be urged that I have made the requirements too high and I will reply by asking if less is demanded of the physician who specializes in other branches of medicine and yet with the exception of surgery there is no part of

medicine the practice of which is capable of destroying life so quickly as is the administration of anesthetics.

All matters pertaining to the department of anesthesia should be referred to the anesthetist in charge. He should be privileged to purchase, at the hospital's expense such apparatus as is required for successful work. He should also be allowed the brand of anesthetic that according to his experience and investigation is the most efficient and the safest.

The author cannot refrain from making a plea for the unfortunate poor in our county institutions. The hospital management should not allow these people to be used by a set of faddists to demonstrate some new agent or method of anesthesia or to revive a method which has been abandoned because of high mortality or evil secondary effects. The economic and social value of a charity patient may be greater than that of the private room millionaire.

REMUNERATION.

For years the professional anesthetist has been recognized in England but it has only been recently that the United States has developed this speciality although the first anesthetics were given here and the greatest advancement in this science must be credited to American physicians.

In order that medical men and women shall devote their time and study to anesthesia the public as well as the medical profession must be taught that safety lies in having the anesthetic well administered and that such expert service must be properly recompensed according to the skill required and the responsibility assumed. It is evident that the medical profession itself does not sufficiently appreciate this point.

Unless the anesthetist is a *full time* teacher with a regular stipulated compensation his services should be paid for by the patient, as is the operation fee. This relieves the hospital of the responsibility and the extra expense of maintaining an anesthetist. This arrangement at once changes the whole complexion of the situation. The anesthetist assumes a personality which he did not before possess for he has been only a part of the hospital machinery and looked upon by the surgeon and patient much in the light that the surgical nurse, orderly or other operating appurtenances are. Patients are not only willing but glad to pay the extra fee if the occasion for it is properly explained to them. The fee to be charged must rest upon the financial circumstances of the patient and the difficulties of the anesthesia. The bills should be sent directly to the patient from the anesthetist and not through the surgeon or the hospital. This latter point is important to the anesthetist as it establishes an acquaintance with the patient and his friends and if the anesthesia has been satisfactory they will think of him if another operation becomes necessary.

110 So. Ashland Blvd.

THE DOWN-TOWN ANESTHESIA CLINIC.*

R. M. Waters, M.D.
Sioux City, Iowa.

The subject assigned to me is so foreign to the thoughts uppermost in the minds of us all that I feel almost a slacker in presenting it. However in due time the war will be over and it is possible that many of us may land, thereafter, in new locations. In case we do I feel sure that a short story of my experiences may be of some value.

In 1915 my practice consisted largely of anesthesia and I was using my home as telephone headquarters with no office whatever; doing largely anesthetics for major surgery in the various hospitals. An occasional call from a dentist however broke the routine and in many such cases the dentist and patient alike objected to going to the hospital both because of the time and expense involved. It was suggested to me that a down-town office equipped to care for dental and minor surgical cases would be useful, as we had no exclusive specialist in exodontia in our town, and some surgeons were also anxious to establish extra hospital clinical facilities.

After the Mexican border demobilization in 1916 I made bold to try such a plan, my practice from that time being confined exclusively to anesthesia. An office was equipped with a waiting room and a small operating room with an adjoining room containing a cot on which a patient could lie down after his anesthetic. In due time the place became popular and we moved. I say *we* for two reasons. First, it avoids a too egotistical repetition of the pronoun *I* and second, chiefly because my office assistant, a girl of twenty-one, has been more than half responsible for the success of the experiment. Her interest and faithfulness have made it possible to make definite dates and keep them

*Read during the Fourth Annual Meeting of the Interstate Association of Anesthetists with the Indiana State Medical Association, Claypool Hotel, Indianapolis, Ind., Sept. 25-27, 1918.

properly, and see that no dentist or surgeon has felt himself slighted or inconvenienced. I bespeak for any of you, who may make a like venture, a careful selection of your assistant and I wish you good luck.

In February 1918 we found ourselves with three units of floor space in the newest and most central office building of our town. The population is 65,000 and we have a hundred doctors and fifty dentists in peace times. In this building some fifty doctors and dentists have their offices. We are equipped with a large reception room with easy chairs and reading matter to divert the attention of fond relatives. Our operating room is of ample size with large south and west windows. In it we have a modified French chair-table such as you have seen Drs. McKesson and Denman use in Toledo for tonsillectomy and nose work. This we find very convenient for the dentist's use also, as it can be tilted into a half reclining position readily and quickly back to the head-forward position during recovery after bloody extractions. It also makes an excellent flat operating table. We have also a dental engine, a sink with foot pedals to turn on water and a sterilizer for instruments, gauze, towels, gowns, et cetera, and a sterile water tank. In short the usual equipment for a minor surgery room. The sterilizer, however, we plan to replace with a better one in an adjoining room which we also use for storage of supplies.

To each side of the operating room is a room containing two or three cot-beds; separate doors open into each room through which the operating chair will roll with ease. Thresholds for such a door we have found are a nuisance and should be removed. One of these rooms we use for female patients and the other for males. There is running water in each, a mirror, etc. One thing we miss very much is a toilet and one should not be forgotten when planning such a place in a new building.

In addition, off the men's retiring room, I have a private office with desk and chairs which serves also as a good loafing and smoking room and a place in which doctors can wait when they are early; it has a separate exit to the building corridor.

Our hospital work with major surgery still occupies half our times and makes up half our income but that is mostly accomplished in the earlier part of the day. The down-town work consists of noon-time and afternoon appointments and occupies time which would be otherwise idle.

Dentists bring all sorts of difficult extractions and painful cavity preparations. Surgeons bring circumcisions, abscesses, and fractures and are gradually bringing more minor operations as time goes on. The head specialists bring some work and they too are gradually bringing more. Some dentists who used to attempt their own anesthesia now bring it to us. Others still do their less difficult cases and bring the more difficult ones to us. We take all sorts of cases, always attempting to give satisfaction regardless of expense. I mean we don't save anesthetic agents and let the patient feel the operation. We make careful physical examination on all suspicious risks. Others are accepted as they come. A sphymomanometer and stethoscope are constantly present and frequently used. Here again the well trained and alert assistant is useful. She often warns me that the next patient is short of breath or shows some other evidence of needing careful examination.

We attempt, as I said, to give satisfaction to operator and patient and charge a fee that will pay expenses and a good profit. We make no fees in advance and have no set prices. Sometimes one tooth extraction takes ten seconds and sometimes it takes an hour and a half. The cost of materials and the value of our time make it necessary to gauge the fee by the work. Our minimum fee, with present cost of materials is seven dollars, the maximum is usually not over fifteen dollars. In other words our fees are considerable less than for similar work in hospital because less time and trouble is involved.

As to anesthetic agents used we aim to use N_2O-O as a routine. In particularly nervous patients we use as preoperative sedatives morphin and scopolamin, sublingually, as a rule. Ether we add very rarely and of course no chloroform for we do not use that even in the hospital.

We keep a card record of every case with physical findings when made, approximate weight, sex, complexion, and other details and also the assistant's estimate, each time, as to the degree of satisfaction to patient, surgeon and dentist. Also a record of what work was done and the length of time.

As to the satisfaction of my patrons. I think I can say this: there are none who have fault to find with our work. We aim to keep an abundant supply of N_2O-O and use it freely. Many patients and some doctors object to the fees but

they come back and their friends come back. Satisfactory anesthesia and too large fees work out better than bargain sale fees and unsatisfactory anesthesia; especially as in open mouth work one cannot wisely be over economical of gases when using N_2O-O anesthesia. People forget the fee but they never forget the hurt nor fail to tell their friends about it.

We have made no start with local anesthesia as yet but have plans regarding it for the future. I believe it a very useful addition in connection with such an establishment as I am describing. I know that many dentists would appreciate such service greatly as they prefer not to bother with learning the technic of local nerve-blocking and would feel safer in employing one who devotes his time to such work.

As to the preoperative preparation of patients we worry little about it. We prefer, when possible, a light meal for the last before the operation. Liquids are allowed at all times. Much of our work is done just before or during the noon-hour because patients have then an empty stomach and at the same time we do not disturb the usual routine of the patient in regard to eating. Every patient takes off his or her outer garments above the waist and corsets are removed by the women. A sheet serves as drapery when coming to the operating room. Every case must go to the toilet before undressing.

As to the after-care the only difficulty is to be sure that patients with blood in mouth or nose, spit it up and do not swallow it. That we accomplish by using pharyngeal packs during the operation when necessary for dental work and by changing to head forward position before removing the pack. The patient is usually awake before the pack is removed in such cases. Then the lateral position in the cot with face turned down by the pillow makes it easy to expectorate without rising up in bed. In this way we have little swallowed blood and little vomiting. The time required for recovery varies from one minute to three hours. Occasionally a woman in poor health who has been nauseated requires help to get home but this occurs rarely.

As to the success of the venture I think I can say that the men who are familiar with the place are well pleased. The place has been running in its present location now for eight months and is paying my total expenses with a nice profit besides.

I hear objections both from doctors and patients as to prices, occasionally. That bothers me not at all. I attempt to pay expenses and a net fair fee for myself in each case. I don't care to work on any other basis. The one thing I do strive for is to satisfy patient and operator. If I fail in that I wish no fee and I collect none. In the long run I believe that plan wins out.

As for *business getting* activity it is all with the dentists and physicians. The place is for their use and their convenience and consideration for them comes first. If Mrs. Jones calls up in regard to an anesthetic, because her neighbor Mrs. Brown was pleased, I ask after Mrs. Brown's health and tell Mrs. Jones to make any arrangements she sees fit with her dentist or doctor. His office calls mine and makes the appointment.

One point which we lay emphasis upon and which I think is a business getter is prompt collection direct from the patient. We never bother a physician or dentist about a patient's bill. A statement is rendered before the patient leaves the office and seventy-five per cent pay them. If there is to be a loss we assume it, preferring not to bother the doctor with finances. So we avoid making an enemy of the doctor and patient alike, for every patient who owes you is your enemy.

The future for such a venture, I believe, is bright. I know ours is not yet half-grown. Several additions have been planned for the immediate future; one, a permanent graduate nurse assistant. So far we have only employed the extra assistant as occasions demanded.

We have considered seriously the manufacture of our own N_2O also. Frequently other additions suggest themselves or are suggested by physicians and dentists. When the war is over I trust many of you may develop down-town minor surgery and dental clinics of much larger scope.

539 FRANCES BLDG.

THE INTERSTATE ASSOCIATION OF ANESTHETISTS HAS BEEN ACCORDED THE DISTINCTION OF A JOINT MEETING WITH THE AMERICAN ASSOCIATION OF GYNECOLOGISTS AND OBSTETRICIANS, ONE SESSION OF WHICH WILL BE DEVOTED TO PAPERS OF MUTUAL INTEREST. THIS FIFTH ANNUAL MEETING WILL BE HELD IN CINCINNATI, OHIO, SEPTEMBER 15-17 AT THE HOTEL GIBSON, WHERE THE INTERSTATE WAS ORGANIZED IN 1915. A LARGE AND ENTHUSIASTIC ATTENDANCE IS EXPECTED SO MAKE YOUR HOTEL RESERVATIONS AT ONCE.

ORGANIZING THE SPECIALTY OF ANESTHESIA.*

F. H. McMECHAN, M.D.,
AVON LAKE, OHIO.

The Specialty of Anesthesia began its organization in the old London Society of Anesthetists, which has since become the Anesthetic Section of the Royal Society of Medicine. Here in America the first effort at organizing the specialty was made by a number of anesthetists who founded the Brooklyn Society of Anesthetists, which later was elaborated into the New York Society of Anesthetists. In 1912, at Atlantic City, during the meeting of the A. M. A., the American Association of Anesthetists was founded and held its first scientific session in Minneapolis the following year. In May, 1915, the Interstate Association of Anesthetists was formed in Cincinnati during a meeting of the Ohio State Medical Association. Other smaller clubs of anesthetists have been established in Louisville, Ky., Providence, R. I., Indianapolis, Ind., and Kansas City, Mo. The only other foreign society is the Scottish Society of Anesthetists founded in 1915.

This organization of the specialty spells progress. Not only have these organizations been founded, but an Official Organ, the Quarterly Supplement of Anesthesia and Analgesia and the American Year-Book of Anesthesia and Analgesia, have been established to take care of printing the transactions of the various associations and collating all the international research and clinical progress in anesthesia and analgesia. While this brief résumé would indicate that a good deal has been accomplished, much still remains to be done in many ways before we can flatter ourselves that the specialty of anesthesia has really been organized.

In a Welfare Session it would seem very *apropos* to discuss the organization of our specialty further.

To begin with no association can thrive without a large membership and the specialty itself cannot be said to be organized unless practically all anesthetists are active members of one or more of the associations.

At the present time some of the associations are not entirely fulfilling their purpose, while other associations should be formed to cover additional territory.

Thus the New York Society of Anesthetists, while it has drawn some members from outside the state, holds its meetings in New York City and to all intents and purposes helps to solve no problems in the specialty of anesthesia, except as they effect its New York City membership. Now this is entirely too curtailed an activity. It would seem to me that the outside members should request the New York Society of Anesthetists to enlarge the scope of its activities. Its membership should be drawn from the entire East and Atlantic Coast States and to accomplish this all its meetings should not be centered in New York City. It could very readily have one or more local meetings, but at the same time, following the policy of the Interstate Anesthetists, it should also hold annual or semi-annual meetings with various State Associations, medical and dental, requesting Joint-Sessions as features of its programs. In this way it would carry its message of organization throughout the entire East.

Having adopted this policy from the very start the Interstate has accomplished considerable in a very short time. At the present moment, however, the Interstate cannot meet the demands of the West for organization and it has been suggested to several prominent Western anesthetists that they organize a Western Association of Anesthetists to meet with the various state or national surgical and dental associations as opportunity presents. Such a Western Association may eventuate during the coming year.

With these three associations, the Eastern, Interstate and Western Association of Anesthetists, in full swing, the country will be adequately covered, although eventually a Southern Association may also have to be formed, which could meet with the Southern Medical Association and state societies. The point to be driven home is that the specialty of anesthesia will only be recognized as such after it has been accepted for Joint-Sessions by the profession and after the public becomes educated regarding its existence.

Apparently, from the foregoing remarks, the American Association of Anesthetists has been disregarded. However my intentions are quite the reverse. The idea is to preserve it, as the national organization and secure in its membership every member of every other Association of Anesthetists. Also it would meet, as is customary in all parts of the country and thus every third or fourth year it would hold a Joint-Meeting with the Eastern, Interstate, Western or Southern Association of Anesthetists, and the A. M. A., the Clinical Congress of Surgeons, the Southern Medical, the Western Surgical or some other important organization. With such a complete organization the specialty would

* Read during the Fourth Annual Meeting of the Interstate Association of Anesthetists with the Indiana State Medical Association, Claypool Hotel, Indianapolis, Ind., September 25-27, 1918.

be in a position to achieve distinction and its campaign for recognition and progress would get along very rapidly in all sections of the country.

All this does not mean that the smaller organizations or clubs of anesthetists cannot accomplish a great deal. Personally I look forward to the day when every large city will have its Anesthetists' Club composed of those in the allied professions of medicine and dentistry who specialize in anesthesia, with an invited membership composed of the surgeons interested in their work. Already certain large cities have been able to establish these clubs and it is interesting to note that cities of the size of Columbus, Ohio, have enough to organize.

These clubs will be extremely important in organizing the specialty in the larger centers, while the other larger associations care for organization in a state or interstate-wide fashion and the A.A.A. looks after nation-wide interests. It is my impression that city organization will solve certain unprofessional activities more quickly than anything alse. It seems a remarkable fact that New York City should support some 60 anesthetists and Philadelphia scarcely any, while in the latter city the non-medical anesthetist flourishes. Invariably there are few if any non-medical anesthetists where there are a sufficiency of expert physicians or dentists to specialize in anesthesia.

It would appear to be a splendid policy then for all of us who are in a position to do so to encourage and participate in the organization of local clubs of anesthetists. These should not be made strictly scientific societies, but semi-professional and semi-social organizations. Meetings at each others homes or certain clubs with one or two papers and a light luncheon would be a very attractive thing. In this intercourse anesthetists would soon learn not to cut each others throats and could readily solve the menace of the non-medical anesthetist by booming the business of those surgeons who took an ethical viewpoint of their employment. Also a great deal of pressure could be brought on hospitals to have them do the right thing by anesthetists and internes.

With regard to these local clubs it must be realized that a new specialist in anesthesia developed in its midst or coming in from the outside, while for a very brief time, he or she may take away some business from the others, his or her expert work will quickly produce just that much more business for the others. This has been found out by experience in every city in which one pioneer began specializing in anesthesia only to make way for at least another specialist every year. I know of cities, now boasting ten or twelve specialists in anesthesia, which ten years ago had none. Also it is more or less up to the local clubs to train those anesthetists who are needed throughout the state as a result of the campaign of education waged by the larger associations. One of the finest things an anesthetist can do for himself and his specially is to bring in some physician or dentist from a smaller town or large rural community having hospital facilities and train him in anesthesia. This sort of fellowship is its own reward, as those who have tried it have found out.

Anesthetists associated with Teaching Hospitals should use the facilities at their command to teach such out-of-town men who wish to specialize. much more may be accomplished by these local clubs in establishing proper education and training in anesthesia in medical schools and teaching hospitals than by any other organizations. They are on the spot, can provide the service and teachers and can formulate policies adaptable to varying conditions. The message to be gleaned from this phase of organization then is just this: Form a local Anesthetists Club. Train enough anesthetists to give every surgeon, specialist and hospital A No. 1 anesthetic service. Train additional men for anesthetic service in the outlying districts; and finally see that proper instruction is given in the local medical schools and teaching hospitals.

Some may say that it would be difficult to get all local men to participate and especially prepare papers. To these I would quote the work of a small society in New York founded by Dr. Gaylord, the cancer specialist. It is sort of an Index and Abstract Club and its members report to the club on certain topics. Thus all of them get the benefit of everybody else's reading. The Supplement and Year-Book and other journals printing articles on anesthesia certainly offer a wealth of material for doing just this thing and many of these articles deserve re-reading and discussion. It is quite possible for such a local club to make its members exceptionally conversant with the world's literature on anesthesia and a club which does this will hold meetings that will very frequently attract their surgical friends. If especially good papers are developed they can be placed on the programs of the larger meetings.

Again these local clubs can and should secure Symposium nights at their local Academies of Medicine for the presentation of papers of interest to all concerned. Anesthetists and surgeons from other parts of the state could be invited to present special papers. There is enough progress latent in

one of these local clubs to make your head swim at the very thought of its possibilities.

The Interstate Association grew out of the refusal of one man on the Program Committee of the Ohio State Medical Association to entertain the idea of a Joint-Session for the presentation of papers of anesthetic interest. Since that time the Interstate has been accorded Joint-Sessions with the National Dental Association, a session that eventuated in the formation of a permanent section on Anesthesia in that organization; with the Mississippi Valley Medical and now with the Indiana State Medical Association. These Joint-Sessions cannot help but have their influence in securing the proper recognition of anesthesia as a specialty.

With the Eastern, Interstate, Western, Southern and American Associations all holding Joint-Sessions with other medical, surgical and dental organizations, the campaign for progress will be fairly launched.

While an Official Organ and a Year-Book were dream-children not so many years ago, there remains another dream-child to be given reality—Anesthetic Foundation. Sometime or other, when the good that can be accomplished through such a Foundation has been driven home to somebody with money to back it, there will be established a permanent home for the Specialty of Anesthesia, which will house a circulating library of the world literature and reprints on anesthesia to be loaned to all members of constituent societies. This Foundation will enable the Official Organ to branch out into an independent journal of larger size and increased scope. It will enable the Year-Book to be published without thought of cost or limitations and finally it will provide a laboratory to which most eminent research-workers in the world can be invited to pursue their investigations. These in turn, with noted clinicians will give occasional public courses in the most advanced points of anesthesia, calculated to give the specialists something to interest them even more profoundly than our meetings.

Such a Foundation, would of course be international and would accomplish for the world-at-large what we have been trying to do in a more limited sphere. Stranger things than this have come to pass.

Personally, in closing, I want to express my own appreciation of the cooperation that has been extended me in working out details of what organization has so far been accomplished by those in the various associations, who have been vitally interested in the welfare of the Specialty of Anesthesia. United effort has certainly borne fruit and if only all those who still have the enthusiasm and desire to continue our progress will continue to cooperate there is nothing that cannot be accomplished. Perhaps the greatest solace of my enforced leisure has been the realization that it has been put to a good purpose. My continued disability leaves me in a position in which my desk can be a centralized exchange for anesthetic progress. I only ask that the calls be made frequent. Connections will be made promptly and a willing, cordial, cooperate service maintained.

VAPOR ANESTHESIA FOR ORAL AND FACIAL SURGERY.*

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So great an authority as Gwathmey recently remarked that the vapor mask, or semi-open method of anesthesia, should be used in operations on the head, neck and upper thorax; that the closed method should be employed in abdominal and other operations requiring relaxation. The method and technic described later may be considered an open method, as there is no other than incidental rebreathing.

The accomplishment of a smooth, satisfactory and uninterrupted anesthesia, for prolonged surgical work within the mouth or about the face, is by no means an easy or a simple matter. It is for this reason that doubtless both surgeons and anesthetists have contented themselves with the unsatisfactory technic of an interrupted administration with its delays and its dangers. The latter are at least two-fold, for we know that an anesthesia going from deep to shallow,—an anesthesia in which the procedure is a very profound induction, then withdrawal until the reflexes return, or even until voluntary muscular action is noted; (this to be repeated many times),—is more dangerous than a smooth and continuous maintenance of anesthesia at a given depth. And, also, as a proper aseptic technic cannot be adhered to under an interrupted or intermittently administered anesthesia, the danger of infection is that much increased. Furthermore, if there were no other reason for improvement over the method mentioned, the fact that it is unscientific and a makeshift should be sufficient.

Intratracheal anesthesia, with the complicated apparatus necessary for its employment and the dangers incident to and arising solely from the method, I am free to say, has never impressed me

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favorably; and in trying to improve my technic for that class of cases in which free access to the inspiratory inlets was denied by virtue of the character of the operation, I searched for apparatus which would be at once simple, compact and satisfactory. I believed that a better understanding of anesthesia by intrapharyngeal insufflation would enable me successfully to anesthetize any patient for operations in which the intratracheal method was especially advocated.

There is, of course, nothing new in any of the simple paraphernalia which is herewith described, and nothing with which the members of this society are not familiar; but inasmuch as the mere fact that smooth, deep anesthesia could be maintained for an indefinite period while surgical work was in progress within the mouth, or about the face or neck, has seemed a revelation to some surgeons for whom I have used the intrapharyngeal method, I thought a brief description of the method might be of interest, and convince some that simplicity and lack of elaborate and complicated equipment are not incompetable with efficiency.

The term vapor anesthesia is inaccurate as any inhalation anesthesia is "vapor anesthesia"; but as the term is used we mean that the agent is vaporized in a closed container at a distance from, and the vapor then conducted to the patient; and by intrapharyngeal vapor anesthesia we simply mean. of course, that the vapor is discharged within the mouth or pharynx whence it is taken into the lungs by normal respiration.

The Hitz bottle, which is merely an improved Junker, and the foot bellows are all the apparatus needed, save, of course various vapor conductors; mouth gag, nasal tubes, pharyngeal tubes, or cheek hooks. There are much more elaborate outfits to be had; there are two and three-bottle vaporizers to be seen with and without heating apparatus attached; and there is an electric motor blower. But I believe the foot-bellows and Hitz bottle are as efficient as any, besides being cheaper and much more portable. One soon learns to control the volume of air with the bellows and the Hitz bottle is so made that all or any portion of the pumped air may be forced through the anesthetic agent. This is its advantage over the original Junker. The bellows may be worked at the same speed and the same volume of air be pumped, while the controller on top of the bottle may be adjusted so that much or little anesthetic vapor is conducted to the patient.

At the "air" or inlet tube of the Hitz bottle I have had a Y made with a stopcock on one arm. A cylinder of oxygen is attached to this for emergency use, or to augment the atmospheric air current from time to time, if cyanosis or other indications for increased oxygenation be observed. Cyanosis is not an uncommon complication as the operative procedures are frequently of a character to mechanically shut off the air way by accumulation of blood, pressure sponging or instrumentation. Such mechanical interference with breathing should not be permitted to become embarrassing.

The Junker type of apparatus is open to the theoretical objection that a "constant vapor" is not maintained. A "drop" or "surface" evaporation type meets this objection, but for the use of the mixture later advocated, I believe the Hitz apparatus the best style.

The constant agitation of the mixture by the air passing through assures the delivery of a vapor in which the proportions are practically the same as in the liquid mixture. There is no fractional evaporation, which may result in a vapor far stronger in chloroform than was intended, or than the fluid mixture represents.

In pharyngeal insufflation, says Coburn, after the patient is deeply anesthetized, the short catheter is passed through the nares into the pharynx and the insufflation begun. The amount of air insufflated need not always be so much as that required in the intratracheal method, but the amount of ether vapor must be the same. The obstruction at the base of the tongue is automatically removed in the pharyngeal method also, but not quite so perfectly as in the intracheal method. While tracheal insufflation has heretofore been extensively used in chest surgery, yet pharyngeal insufflation possesses special advantages for this very work. After the chest cavity is opened, the distension of the lung is under more pliable control with pharyngeal insufflation, as such distension is continuous in the tracheal method and the distended lung is always in the field of operation on account of this distension and thereby interferes with the work of the surgeon, whereas in the pharyngeal method, the lung of the side under operation collapses, thereby facilitating the work of the surgeon. When the operation is completed and the surgeon is ready to tie the last sutures, the collapsed lung is easily and quickly expanded by placing a wet towel over the patient's face. This retards the outflow of air and insufflated air is of such volume that it quickly distends the lung.

For the best results I wish to advocate the use of a chloroform-ether mixture for vapor anesthesia. Induction may be by any method, the nit-

rous oxid-oxygen-ether sequence being my preference; or in young children the essence of orange-ether sequence; but for maintenance a mixture of chloroform and ether is used. The proportions in most cases are roughly, chloroform one part and ether two parts, but these are varied according to the type of patient, and the chloroform is increased in the mixture in proportion as difficulty in maintenance is anticipated. Chloroform is a more powerful narcotizing agent than is ether, and as we cannot in these cases cover the entire mouth and nose for air exclusion, we find chloroform is the better acting anesthetic for the method. However, reinforcement with ether is essential for its stimulating effect, so that the profound depression of chloroform alone may be counteracted, as a measure of safety.

Clinically and practically a mixture of chloroform and ether, in which chloroform forms from one-third to one-half of the mixture, gives a narcosis which acts like chloroform anesthesia and looks like an ether anesthesia; *i. e.* profuse mucous secretion is not observed, anesthesia of proper depth is more easily maintained; but the color of the patient remains rosy, circulatory depression is not evident, and blood pressure does not become reduced.

This action of chloroform-ether mixture may seem paradoxical to many, and those whose prejudice against chloroform extends to an almost complete elimination of it from their armamentarium argue that I do not and cannot get the advantages of both agents while counteracting the disadvantages of each with the other, and that I am merely subjecting the patient to the dangers of both. I can only reply that observation and experience, which count for more with me than theoretical reasons, merely strengthen my views on the efficiency and safety of chloroform-ether mixture as used for intrapharyngeal vapor insufflation.

For those cleft palate and harelip cases which are operated on very young—under two years of age—chloroform alone is used by this method. The immediate risk is great if we maintain a narcosis throughout of sufficient depth to keep the throat reflexes abolished, yet we should be satisfied with no less perfect an anesthesia. With chloroform, the line between deep anesthesia and fatality is always narrow. An anesthesia which precludes coughing and strangling when the throat contains blood, and the head is kept in a straight position, with the face looking directly upward—thus permitting all saliva, blood and mucus to trickle by gravity to the larynx—is necessarily profound. And in children at the age mentioned at almost any time during such a maintenance an extremely slight increase of chloroform vapor, added when the narcosis is already deep, may swing our anesthesia across the safety-line to a sudden fatality. Thus eternal vigilance is the key to satisfactory anesthesia in these cases.

In my hands this simple method, with its equally simple and readily portable outfit, has displaced all other methods and apparatus for anesthesia in the surgical work to which it is adapted. Hare-lip, cleft palate, excision of the lower jaw, labial epithelioma and similar operative cases are all anesthetized in this way. The pharyngeal tubes and funnel inhaler method have long since been discarded, personally, as never having been entirely satisfactory in my own hands. The intratracheal method I have never routinely adopted, believing that its physical and mechanical dangers are great, and that the pharyngeal method enables me to secure more satisfactory results for the surgeon, patient and anesthetist.

SOME OBSERVATIONS ON THE LIMITATIONS OF NITROUS OXID-OXYGEN ANESTHESIA AND A RESTRAINING DEVICE FOR THE OBSTREPEROUS PATIENT.*

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Aside from the title of this paper, it is safe to say that in ninety-nine and nine-tenths per cent. of cases there are practically no limitations to the use of nitrous oxid-oxygen, where either an anesthetic is indicated or where conditions are such as to necessitate the administration of an anesthetic regardless of existing pathological conditions. The degree of the anesthetist's skill and the condition under which he operates alone create the limitations.

In nitrous oxid-oxygen we have found one of the greatest pain-relieving agencies for the benefit of suffering humanity, and one that can be given under all conditions with the greatest degree of safety, providing it is administered by one who is thoroughly familiar with the technic of its administration. However, it is much to be regretted that up to the present time, out of the large number of practicing dentists who have taken up the use of this form of anesthesia, too few are using it successfully,—due to the fact that insufficient time and study have been devoted to preparation for its application.

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No one would expect to be able to insert a gold filling skillfully or to set up and finish an anatomically articulated denture without having previously given several years of study to the theoretical and practical factors involved in the achievement of such tasks; nor to perform a difficult operation merely upon the directions of the most ideal text-book. In like manner, a successful analgesia or anesthesia cannot be accomplished by reading a general treatise on the subject, witnessing a few practical demonstrations and making half a dozen more or less disappointing attempts at administering these gases; yet this is what is being attempted every day by certain members of the dental profession, too lax to master the intricacies of anesthesia.

Their result spells failure and condemnation of what in reality, as a pain-relieving agent, ought to take the foremost position as a factor in building up a practice. From personal observation we all know that there is no branch of dentistry for which the public manifests a greater degree of appreciation than for that which aids in the elimination of pain, and the man who is proficient in this direction has no difficulty in building up a clientele. I wish, therefore, to impress upon the members of the profession the importance of a complete mastery of the science and art of nitrous oxid-oxygen anesthesia, which will, in return, more than compensate them for the effort involved.

However, granting a high degree of skill on the part of the operator and ideal conditions of administration, there still remain certain limiting factors affecting results in the employment of this anesthetic from the standpoint of the dental practitioner. Diabetic or nephropathic patients may be classed under the head of limitations, as they are apt to fall into diabetic or uremic coma from which recovery is not assured, even after of a short anesthesia lasting only three or four minutes. In hospital service where urinary analysis is practical and available such conditions may be recognized and dealt with accordingly, but in a private dental office a thorough physical diagnosis is impracticable for ordinary exodontia or routine operative dentistry. It is, therefore, advisable for the dentist first to acquire a history of the patient from the family physician, and if a large percentage of sugar or albumen is present, to employ conductive anesthesia in these cases.

Unless the anesthetist has had considerable experience it is unsafe to administer nitrous oxid-oxygen to children under five years, as they readily come out from under its influence, and are prone to sudden asphyxia, unless the anesthetist has sufficient knowledge and presence of mind to use the emergency oxygen valve and artificial respiration. Children are also subject to sudden death under anesthesia from status lymphaticus.

In the class of limitations also should be included such types of patients as chronic alcoholics, dope fiends, and individuals partially or wholly under the influence of alcoholic stimulants. These are, in most cases, difficult to control and to operate on with any degree of accuracy, due to their resistance, muscular rigidity, and a tendency to realism in their dreams and hallucinations, unless a restraining device is employed, or a hypodermic of morphin and scopolamin is given previous to the administration of the anesthetic. Owing to the utter lack of preanesthetic preparation, the average dental practitioner is obliged, so to speak, to snatch his patients right off the street, and it frequently occurs that patients will follow the old-time layman's course of preparation by imbibing two or three good high-balls so as to instill a little courage into their system previous to an exodontia operation. These are the patients who give events an unexpected turn, unless the anesthetist is fully prepared with trained assistants and a reliable restraining device. If conditions are detected early enough it is perhaps wise to discharge the patient for the time and have him return the next day in better form.

Having admitted that nitrous oxid-oxygen has certain limitations, it would seem appropriate, in connection with this subject, to consider the addition or the substitution of other methods of anesthesia. Not all cases being of one pattern we cannot depend upon a single agent for universal application. The human factor must always be taken into account, and each individual case must be carefully studied, before deciding upon the method to be followed.

In prolonged dental operations, such as impactions of third molars, impacted roots requiring time and accuracy, or extraction of twenty to thirty teeth at one sitting, where the operator lacks the desired team-work of trained assistants and ideal office facilities, and where the patient is not of the extreme apprehensive type, great advantage may be gained by the use of conductive anesthesia. This may be employed in such cases for the entire operation, or simply to complete the preliminary operative measures,—the remainder of the work to be done under nitrous oxid-oxygen.

This method of combined anesthesia has the advantage of avoiding prolonged general anesthesia for minor details, thereby assuring a more rapid recovery, gives the operator a clearer vision of the field of operation in the oral cavity, eliminates excessive hemorrhage during the operative period, avoids

the gagging and swallowing of blood incidental to a general anesthesia, and prevents immediate post-operative pain. Furthermore, in conductive anesthesia, either alone or followed by nitrous oxid-oxygen, we have the possibility of ideal results through a combination with novocain-suprarenin, in the reduction or elimination of shock. Nitrous oxid-oxygen eliminates the shock of the conscious mind during the major portion of the operation, while the novocain-suprarenin eliminates the shock to the nerve centers usually caused by the traumatic injury.

There are many incidental factors which account for many failures in nitrous oxid-oxygen anesthesia. In some dental offices there is an absence of any proper system of arrangement, particularly with regard to the psychic effect upon the patient. The waiting room is commonly in close proximity to the operating room, so that any disturbing action or noise from the latter, due to hysteria and hallucinations, is conveyed directly to those waiting for the coming ordeal, creating an unfavorable and a lasting impression, producing a dread and a resistance very unfavorable for the successful administration of the anesthetic. The sight of an occasional, nauseated patient or of the actions of a resisting one, accompanied by the presence of blood and the mess of surgical procedure, are impressions passed on by patients to some new friend or neighbor, aggrevating the very psychological condition we are striving to correct.

In addition, as a causative factor of apprehension, there are, in some dental offices, repulsive surgical features, such as pictures of dissecting rooms with partially dissected cadavers lying upon the slabs, surrounded by a number of students clad in their white gowns, and, to complete the decorative scheme, two or three human skulls distributed about the room, objects giving more the appearance of a medical school ampitheatre than of a cozy, home-like waiting room, all have a tendency to create a state of mind unfavorable for a successful anesthesia. In the operating room, likewise, all display of instruments and other armamentarium should be avoided. Gas cylinders should be kept in a separate room, and the gas and oxygen piped into the operating room; the gas apparatus and dental engine, should be concealed in cabinets and not brought into view until the patient is anesthetized. In short, the office should not be a dental and medical exhibit, but rather should present, as much as possible, a home-like environment, thereby inducing in the patient a quiet, restful and relaxed frame of mind.

To the above considerations might be added tidiness of the office, operator and assistants, and the ability to inspire the patient with confidence, by a care-free and cheerful manner, and by reassuring conversation as to the absence of danger, unpleasant sensations, failure to recover, and possibility of pain. The prime requisite for producing this psychological effect is that the operator must have the utmost confidence in himself and in the anesthetic. The patient, during these trying moments, can very readily sense any sign of weakness or want of confidence on the part of the operator.

So while the efficiency and safety of gas-oxygen is practically unlimited, when administered under unfavorable conditions its limitations may become unlimited.

Now as to the obstreperous patient. It is a fact well known to everyone using nitrous oxid-oxygen extensively, that some patients when under the influence of this anesthetic, will at times threaten to clean up the shop while laboring under some hallucination such as becoming involved in an imaginary argument or fight, thereby rendering operating extremely difficult and at times almost impossible even for the professional anesthetist. The effect upon the novice of such an experience is very discouraging. He is likely to join in the condemnation of nitrous oxid-oxygen, push his gas apparatus aside to become dust-covered, discourage his patients from enjoying the blessings of anesthesia, and go on extracting teeth in the same old way as his ancestors did.

Realizing these conditions and also admitting that I may have been somewhat deficient in mastering these difficult cases, I have recently devised a restraining apparatus for the obstreperous type of patients.

This device consists of a wide stiff leather apron to which two straps are attached on either side extending around the back of the dental chair and there connected by means of a buckle; this prevents one frequent source of trouble, namely the patient sliding out of the chair, which in the rigid condition of the patient (providing the operator is accustomed to work with patient in an upright position, frequently consumes a great amount of valuable time, thereby prolonging the period of anesthesia unnecessarily. The rigidity and extreme width of the apron distributes the pressure uniformly and widely over the abdomen and chest thereby preventing too much pressure upon the diaphragm and avoiding interference with free respiration.

Secondly, I have attached to the device a pair of padded leather cuffs connected to the straps by means of a metal staple, so arranged as to slide back and forth on the straps, and adjustable to patients

of various build and size. These prevent the patient from interfering with the operator by unconsciously swinging the hands and arms around or grasping the inhaler.

The cuffs are equipped with a brass post extending through the holes in the cuff-band punched a short distance apart so as to fit snugly to wrists of varying circumferences and locking by a small metal bar the same as used in locking doors from the inside.

This device can be quickly and noiselessly attached either before the anesthetic is begun or after the patient is partly anesthetized, being slipped in under the linen apron with which the clothing of the patient is protected against blood stains.

Fig. 1. Demonstrating Application of the Restraining Device.

In case of patients whose work calls for especial accuracy or prolonged anesthesia, manifesting a tendency towards uncontrolability, I also use a pair of anklets attached to the foot rest of the chair by means of snaps. These in turn are permanently fastened to the chair with a leather strap slipped through a bracket bolted to the side of the chair. It is rarely necessary to use this.

I do recall one instance in which a big, powerful fellow raised both lower limbs high into the air, bringing them down with such force as to break the castings on both sides of the foot rest near the base of the chair, necessitating considerable expense in repairing the same.

The criticism and argument against this method of procedure no doubt will be the psychological effect upon the patient's mind, as causing increased apprehension.

Even though this may be an undisputed fact to a certain degree, I can truthfully state that I have employed this method in several hundred cases and so far have had only one patient who showed any symptoms of fear. In fact I have reached the point where I never undertake an exodontia operation on a man of any considerable physical strength without it. You may only have resistance in a small per cent. of the cases presenting, but you never can tell when it is going to occur. Even if the device may excite the apprehension of few patients, that is preferable to taking chances of having furnishings broken or of accidentally injuring an adjacent tooth or bridge through some unexpected move of the patient, thereby rendering oneself liable to a malpractice suit.

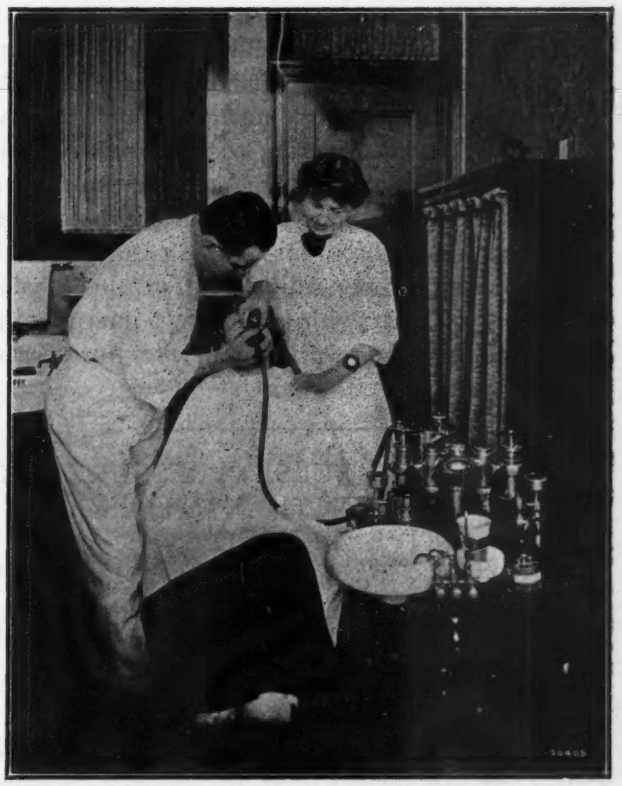

Fig. 2. Administering the Anesthetic.

This method of restraint is advocated only for extraction of teeth and is not necessarily to be used in all cases. A certain amount of tact and diplomacy must also be employed in order to dispel any apprehension the patient may manifest towards these measures of restraint.

In conclusion I would again point out a few of the harmful factors which account for some of the failures in nitrous oxid-oxygen anesthesia. Unpleasant sights, such as waste, unclean linen, blood, and instruments; disturbing noises without and within the operating room, such as passing vehicles or banging doors; deficiencies in the operator's dress or deportment; neglect in properly loosing the patient's clothing or seating them comfortably, and many other seemingly trifling details may have a psychic influence fatal to the operator's success. A thorough knowledge of the physiology and pharmacology of nitrous oxid-oxygen anesthesia and analgesia; judicious consideration of the patient's individual requirements and peculiarities,—pulse, respiration, color, and physical characteristics; a reliable and thoroughtly practical apparatus and intimate familiarity with its working possibilities; a correct gauging of the patient's lung capacity instead of blind reliance upon an average percentage; placing the patient's body according to the requirements of the operation; proper adjustment of the inhaler; intimate familiarity with and correct interpretation of symptoms,—all are prime requisites for success.

FIRST NATIONAL BANK BLDG.

RELATION OF PULSE PRESSURE AND KIDNEY FUNCTION TO OPERATIVE PROGNOSIS *

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During the past two years, at the Long Island College Hospital, we have made an attempt to determine the *clinical value of preoperative pulse pressure* and its relation to kidney function in the operative prognosis of gynecologic patients. This study has been carried out along with our routine preoperative and postoperative blood pressure and blood studies, the preliminary report of which has already been presented to the American Gynecological Society at its 1917 meeting and published in their transactions. The conclusions of this former study will be given at the close of this brief discussion.

In order to make these determinations, the *following preoperative routine has been adopted*: On admission *the cardiac force* of each patient is studied in the following manner: The systolic and diastolic pressure is taken with the patient in the recumbent position, and the pulse pressure noted as *at rest.* The patient is then seated on a stool and instructed to raise the arms and extend and flex the forearms for two minutes, when the systolic and diastolic pressures are again taken and the pulse pressure noted and recorded, as *after moderate exercise.* Finally the patient is made to stand up with the legs spread apart and a pound weight lying between the feet, when she is directed to raise the weight up over her head, then lower it between her legs again, then raise it again, first ten times, then twenty times. The *rate of the heart action is, of course, accelerated* and the *systolic pressure raised,* but if the *heart muscle is of good quality little or no change is noted in the pulse pressure.*

The value of such a test is at once apparent in estimating the quality of the cardiac muscle, especially in those women who have been ill with infective diseases for a long time.

We next make a preoperative estimation of the *sulphophenolphthalein output of each patient, to estimate the renal function.* We have found that, *averaging the normal pulse pressure at 35 millimeters, the "phthalein" output for two hours, in the normal case, averages about 60 per cent.* Where the *pulse pressure is high, say 60 or 70 millimeters,* the *"phthalein" reading will be either high or low, depending on the state of the kidney structures.* When the *reading is low, the pulse pressure has to be relatively high to compensate for the diminished renal function.* On the other hand, when the "phthalein" reading is low, say *20 or 30 per cent. in two hours,* and the *pulse pressure also low, the patient has proven to be a poor operative risk and the cardiac muscle is always questionable.* These patients have given us trouble in their postoperative course.

Our only fatal case, of postoperative cardiac dilatation, showed a preoperative pulse pressure of 24 and a "phthalein" output of only 29 per cent. Under ether stimulation and the Trendelenburg posture, the pulse pressure was maintained throughout the entire operation at 30 millimeters, but promptly on her return to bed and after the effect of the ether had worn off, the pressure dropped to 20 millimeters, and resisted all known methods to raise it. The patient died five and one-half hours after coming from the operating room.

Such an experience led us to make a further study of the effect of ether on renal function as shown by the phenolsulphonephthalein output.

Our routine has been, for several years, to watch the pulse pressure during anesthesia and to take the

*Read at the joint meeting of the Interstate Association of Anesthetists and the Indiana State Medical Association at Indianapolis, Sept. 26, 1918.

systolic and diastolic pressures *immediately at the close of every operation,* while the patient was still under ether stimulation, *again in six hours* and *again in twenty-four hours,* and a record of the *pulse rate every fifteen minutes for the first six hours.* In shock or hemorrhage the pressure is taken every hour until reaction has taken place. A complete blood count and hemoglobin estimation is also made immediately on the return of the patient from the operating room. This *gives us a control for comparison with pressures and counts,* should complications occur in the subsequent postoperative course. *No step in our routine has been of more clinical value than this detail,* as by it alone and in conjunction with blood pressure readings, we have been able to differentiate between hemorrhage shock and postoperative cardiac dilatation.

Six hours after operation the first "phthalein" estimation is made of the kidney function. A catheter is left in place for two hours and the readings made from the collected urine. So far in our work *one interesting observation has been noted, namely, that notwithstanding the diminished urinary output which always follows the administrati of ether in the first few hours, there is only a negligible change, usually not over* 10 *per cent. in the "phthalein" eliminated, provided the pulse pressure has remained normal.*

But three exceptions to this constant observation have been noted, *one a nephrectomy for a large cystic kidney where* the *immediate effect* of *removal of the kidney was to reduce the "phthalein" output from* 85 *per cent. preoperative to* 29 *per cent. postoperative,* yet within thirty hours the output had increased to 65 per cent.

Another exception was a myomectomy in which there was considerable blood loss during the operation with a consequent fall in pulse pressure a half grain of morphin was used during the last half of the operation while the administration of ether was suspended. The operation was followed by severe shock, the blood pressure fell to 78 over 55 millimeters, and remained so for several hours. The urinary output in the first twenty-four hours was 4 *ounces* and the "phthalein" elimination only 20 per cent. It took seventy-two hours before the urinary output and kidney function approached the preoperative record. This is a good illustration of the relation of pulse pressure to kidney function.

A third case, which shows a marked discrepancy between preoperative and postoperative readings, was that of a woman with a large subvesical myoma, who was subjected to a total hysterectomy. Her hemoglobin on admission was only 40 per cent. The systolic pressure 150 over a diastolic of 110 millimeters. This patient showed a preoperative functional "phthalein" of 65 per cent. after twenty-four hours of preoperative rest. She had a light ether anesthesia of nearly an hour, supplemented by a half grain of morphin during the operation. She left the operating table with a pulse of 80 of good quality and a pressure of 155 over 115 millimeters. Her "phthalein" at the end of six hours was 20 per cent. and only 10 ounces of urine was secreted in the first twenty-four hours. This increased to 26 ounces in the second twenty-four hours as did her "phthalein" which rose to 40 per cent.

These two instances suggest to us that while *morphin definitely minimizes the shock* and *may be used to advantage* when *the patient is fully anesthetized to complete the operation without the further administration of ether,* it has the effect of diminishing the urinary output in the first few hours after operation.

In the second case, the low pressures may have had a direct bearing on the kidney output, but in the last the pressure remained constant and cannot be credited with inhibiting kidney function, nor in this case was there any blood loss or shock, hence I feel that it is fair to conclude that the diminished output was directly due to morphin.

From this short study, which now includes more than 200 consecutive abdominal cases, we feel justified in drawing the following conclusions:

1. That the *pulse pressure is a test of the muscular strength* of the *individual woman's heart,* when endocardial lesions can be excluded.

2. That the *efficiency of the kidney function is directly dependent on the cardiac force of the individual, provided the kidney structures are normal or approximate the normal.*

3. That *ether anesthesia of an hour does not disturb the relation of pulse pressure to kidney function unless the operation is accompanied by considerable blood loss.*

4. That when *the preoperative kidney function is low* the *pulse pressure must be relatively high to compensate for the deficiency,* as it does *no good to add saline by skin or bowel or infusion unless there is sufficient cardiac* strength to take it up and carry it along.

5. That *when both the pulse pressure and "phthalein" output are low the operative prognosis should be guarded.*

6. That *morphin in large doses during operation seems to help in diminishing the shock* but has a definite effect in diminishing the kidney output.

CESAREAN SECTION AND OBSTETRIC OPERATIONS UNDER NITROUS OXID-OXYGEN ANESTHESIA.*

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The more frequent use of anesthetics in obstetrics while affording surgical relief for dystocia, the correction of malposition by art, and the repair of injuries to the soft parts, has in recent years stimulated a search for a more ideal and flexible narcotic agent in this field.

Although still widely used, chloroform is recognized as a more dangerous drug than was formerly supposed. Even in the small ineffective doses ordinarily employed in obstetrics, it is under suspicion; while for anesthesia in the toxemias of pregnancy it is openly contraindicated.

Ten years ago, after having become fairly familiar with the action and use of nitrous oxid and oxygen in surgery, I adopted it for obstetrical operations and have used it almost exclusively since. For the past seven years, since Guedel of Indianapolis personally called my attention to its possibilities in analgesia, I have used it extensively in obstetrics for this purpose as well. While it is not my intention to deal with statistics in relation to maternal and fetal mortality and morbidity referable to anesthesia, a subject for a future report, it may be briefly stated that I have had no death in mother or child which was unexpected or in which the anesthesia *per se* has been regarded as a possible cause.

Although the first anesthetic to be discovered, there is still more or less widespread ignorance and misconception of its application and effects in both the dental and medical professions. This is possibly most noticeable in obstetrics.

Operative obstetrics presents differences in anesthesia and surgical technic from the usual surgical operation which are too frequently ignored. There is more than the mother's general condition to be thought about during her anesthesia; there is the mother in a general sense, the uterus and passage in particular, as well as the fetus. Ether for this work cannot be administered *ad libitum* as is sometimes done in a surgical clinic. Such treatment does not fit into obstetrical requirements, but leaves the uterus incapable of further immediate labor should such be desired; and the reaction of the child, if born under profound ether, is often sluggish if breathing begins at all.

These points are familiar to all, but are repeated here because we have seen the parturient treated as a purly surgical case with disastrous results.

Those anesthetists who have seen only the true operative case in obstetrics such as cesarean section, have missed the many obstetrical maneuvers in which the transient anesthesia of nitrous oxid-oxygen aids the art which so often avoids surgery and relieves the mother of much pain and shock.

The mother may be anesthetized for a rotation of an occiput posterior or a version and within two minutes after removing the inhaler she is awake and resuming labor. How is this difference between chloroform or ether and gas-oxygen brought about? Principally by the relatively complete and extremely rapid absorption and elimination of gas-oxygen.

When chloroform or ether reaches the tissues its marked affinity for the fats and fat-like substances of the cell binds it there, making its effects long continued after the inhalation has been discontinued. Moreover, even in light concentrations the vapor is taken up and accumulates sufficiently if inhaled over a considerable period, to inhibit the uterine contractions and in many instances brings labor to a standstill for some time.

Since nitrous oxid is *insoluble* in fats but is exceedingly soluble in blood serum—the normal medium of exchange for oxygen, CO_2, nitrogen, foods, etc.—it has no accumulative action or affinity for tissues by which it might be retained in the body. Therefore, its elimination is quite complete within two minutes.

Even quicker is its absorption. The patient rarely remembers after the sixth inhalation while the relief of the pain of a normal second stage uterine contraction is regularly and conveniently accomplished by three inhalations without interrupting the conscious state. In fact, it would be quite possible to anesthetize a patient during each uterine contraction and have a conscious woman by the time the next "pain" is due. This would be a poor technic in the normal labor, however, since little or no cooperation and straining would be carried out, as she does when in analgesa with consciousness retained.

Many noted obstetricians who have been accustomed to use nitrous oxid and oxygen analgesia have not employed it for complete anesthesia. In many instances, I believe, gas-oxygen has not been selected for obstetrical operations because of erroneous impressions and views gained from older writers and misinterpretation of the mechanism of its anesthesia.

*Read at the joint meeting of the Interstate Association of Anesthetists and the Indiana State Medical Association, at Indianapolis, Sept. 26, 1918.

One of these mistakes is the impression that nitrous oxid-oxygen anesthesia increases blood pressure. A sphygmomanometer used as a routine during operations, as I have done for twelve years, will demonstrate the fact that nitrous oxid-oxygen does *not* increase blood pressure and is not contraindicated in any case of arteriosclerosis, eclampsia, nephritis, brain tumor, etc., as has so often been repeated from one author to another until the literature is permeated with the error.

Another is the false impression based upon the old and exploded asphyxia theory, that nitrous oxid and oxygen will cause a "blue baby."

Nitrous oxid is a true specific anesthetic and may always be administered in obstetrics with sufficient oxygen to prevent cyanotic babies as effectively as if no anesthetic at all were given. It must not be forgotten that blue babies sometimes occur when no drug or anesthetic has been administered, and while cyanosis in these might not always be prevented, they might be effectively oxygenated while circulation in the cord continues, if oxygen is at hand to administer to the mother at the right time.

While the cord pulsates after delivery, it should not be clamped, but the mother should inhale pure oxygen until the baby cries. I have found that this procedure has largely eliminated apnea in the baby and promotes a very prompt, vigorous cry, bringing immediate relief of mind to the obstetrician.

Whether the crusade against vaginal examinations, if followed out, will benefit the parturient generally by lessening infection in a contaminated field, or implies that the physician is unable to diagnose position, mechanism, etc., when he *does* examine, is far from clear. The important fact is, that mistakes in diagnosis of the situation in the birth canal delays the institution of proper treatment if applied at all before the fetus is dead, or the mother reduced to a state of invalidism.

How many times a cesarean section found to be necessary after the mother has exhausted herself, traumatized her pelvic tissues and lost the baby? Can the kind of anesthesia then employed be blamed for the dead baby, a post-partum hemorrhage or a puerperal fever? No, but it may be a contributing or even a deciding factor in some cases of this kind.

It has been argued by some that nitrous oxid-oxygen does not relax muscle sufficiently.

Sufficient relaxation for hysterectomy, gall bladder, stomach, or any other operation is being accomplished, not only in my work, but by many other anesthetists without the addition of ether. Moreover, one of the important things in obstetrical operations is the maintenance of muscular tone by employing as light an anesthesia as possible (without permitting movements). In abdominal cesarean section, for example, once the uterus is emptied, the abdominal walls are lax and cause no difficulty in closing under extremely light narcosis.

It is also well to bear in mind that anesthesia administered to full muscular relaxation not only reduces muscular tone in the abdominal and other skeletal muscle but similarly affects all kinds of muscle in the body, be it uterus, heart, blood vessel or intestine.

Each shows its peculiar effect. If uterus, relaxation and hemorrhage; if heart, inefficient circulation; if blood vessel, lowered blood pressure; if intestine, flatus and adynamic ileus may result. The fact that extreme muscular relaxation, which causes the above pathologic changes is very difficult to obtain with nitrous oxid and oxygen, shields the mother from these phenomena, which are sometimes combined in the same patient.

If there is an ideal anesthetic for obstetrical operations nitrous oxid and oxygen is this agent.

Its transient effect, when removed, permits almost immediate resumption of normal labor; its lack of depression on uterine and other muscle when properly administered; its safety to mother and child; the means at hand for perfusing the child with oxygen through the mother while the cord pulsates.

The hope of reduction of morbidity and mortality in obstetrics, which is still appalling as compared with other advances in medicine, rests much more on the disposition of the midwife who delivers 50 per cent of the parturients in the larger cities. Medicine faces a problem here of vast economic importance to the public, which is singularly parallel to the problem of professional anesthesia.

2233 Ashland Ave.

AN INSTRUCTIVE AND INTERESTING PROGRAM IS IN THE MAKING FOR THE FIFTH ANNUAL MEETING OF THE INTERSTATE ANESTHETISTS WITH THE AMERICAN ASSOCIATION OF GYNECOLOGISTS AND OBSTETRICIANS TO BE HELD IN CINCINNATI, OHIO, SEPTEMBER 15-17, AT THE HOTEL GIBSON. IF YOU HAVE A PAPER YOU WISH TO PRESENT GET IN TOUCH WITH THE SECRETARY AT ONCE SO THAT IT CAN BE SCHEDULED. DON'T HESITATE TO GIVE THE INTERSTATE THE BENEFIT OF YOUR EXPERIENCES AND RESEARCHES.

A SPECIAL EFFORT WILL BE MADE TO HOLD AN OUTSTANDING SECTION ON ANESTHESIA FOR ORAL SURGERY AND DENTISTRY, AND INTERESTED SURGEONS, DENTISTS AND ANESTHETISTS ARE CORDIALLY INVITED TO ATTEND AND FIND OUT HOW THE INTERSTATE MEETS THEIR NEEDS FOR PROGRESS.

THE ANNUAL DINNER WILL BE SERVED AT THE HOTEL GIBSON, AND AS USUAL WILL BE AN INFORMAL BUT VERY ENJOYABLE AFFAIR. THE LADIES WILL BE DELIGHTFULLY ENTERTAINED SO MAKE PLANS TO BRING THEM TO THE MEETING WITH YOU.

BRING IN AT LEAST ONE NEW MEMBER. FOR FURTHER INFORMATION ADDRESS F. H. McMECHAN, M.D., SECRETARY, AVON LAKE, OHIO.

THE ACID-BASE REGULATORY MECHANISM IN ANESTHESIA.*

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Acidosis does not play a part either in the preoperative or postoperative history of the *average* surgical patient, but there is always an increase in the amounts of acid substances formed during the period and as a result of anesthesia. To make this clear, it is necessary to define the sense in which this word *acidosis* is used. Normally there are continuously formed in the body certain quantities of acids as a result of metabolic chemical activities. These acids are promptly neutralized by alkali which the body keeps available for this purpose. When, however, the amount of acid is increased through any cause, and when the reserve supply of alkali has been depleted, symptoms are produced. Ordinarily, the reserve is amply sufficient to neutralize a quite decided increase in acids, but there are occasions when it fails. This is the sense in which we use the term *acidosis.* To express it in another way, *acidosis means insufficient alkali.* An excessive production of acids which is neutralized and does not drain the body of alkali below a certain point, we prefer to call *compensated acidosis* as suggested by Van Slyke and Cullen.[1] *Uncompensated acidosis* is the condition in which the bodily supply of alkali has been depleted to a point where symptoms occur. In anesthesia, therefore, there results a compensated acidosis in *most* patients; that is, in from 30 to 85 per cent. of the run of operative cases; and an uncompensated acidosis results in from 15 to 20 per cent. of the cases.

STUDIES IN ACIDOSIS

Before analytic data had been gathered, even before analytic methods had been perfected, a number of surgeons had assigned a very important rôle to acidosis in surgery. They claimed that it occurred quite regularly after anesthesia, and was an important factor in producing postoperative nausea and vomiting, gas pains, headaches, restlessness, sleeplessness, and general discomfort. Graver disturbances and even death were laid to this condition. The analytic data which have shown the facts in the case, have been secured mostly by estimates of the amount of bicarbonate in the blood plasma. In normal individuals, from 60 to 75 cc. of carbon dioxid are yielded per 100 cc. of plasma. The carbon dioxid is derived practically entirely from bicarbonate. When there is an increased amount of acid, an equivalent increased amount of bicarbonate will be neutralized, and there will, of course, be a smaller quantity of carbon dioxid revealed by analysis. The reduction in the bicarbonate which has been found to occur after anesthesia and operation, averages from 5 to 15 cc. of carbon dioxid per 100 cc. of plasma. With the normal of from 60 to 75 cc., this decrease in the large majority of cases does not reduce the carbon dioxid to below 50 cc. This latter figure may be accepted as the lower limit of compensated acidosis, and above that figure, no symptoms of acidosis will occur.

A reduction in the bicarbonate of the blood has been interpreted in all other countries to an increase in acids. In the case of anesthesia, however, an interpretation contrary to this has been suggested.[2] It is stated that the carbon dioxid of the blood is reduced after ether anesthesia by the blowing off of an excessive amount of carbon dioxid through the increased rate and depth of respiration which occurs during anesthesia. With reduction in carbon dioxid or carbonic acid from increased ventilation, the alkali of the blood would be relatively increased. From recent experiments, it appears that an increased alkalinity of the blood is tolerated as poorly as increased acidity.[3] Therefore sufficient alkali leaves the blood for the tissues. In other words, there is a shift of alkali from plasma to cells.[2]

This interpretation therefore states, there is no increase of acids during anesthesia. We shall show that it is at variance with numerous analytic data.

ROLE OF THE KETONES.

Among the earliest record of analyses of acids formed during anesthesia are those of Reicher.[4] He found, in 1908, an increase in the amounts of ketone bodies, that is, acetone, diacetic acid, and B-hydroxybutyric acid, in the urine after anesthesia. This observation has been repeatedly confirmed by others and ourselves.[5] [6] [7] Direct evidence that these ketones are increased in the blood after anesthesia is also afforded by direct analyses.[8] Further, we have computed, that, on the average, 60 per cent. of the observed fall in carbon dioxid of the plasma is accounted for, molecule for molecule, by these ketonic acids, estimated as acetone.[8] Definite evidence therefore exists of an increase in the blood of at least one series of organic acids. The cause of a large part of the decrease in bicarbonate is therefore demonstrated. Ketones are well-known products of partial or incomplete oxida-

* Read during the Seventh Annual Meeting of the American Association of Anesthetists, Hotel Breakers, Atlantic City, N. J., June 9-10, 1919. From the Department of Pathology of the Lankenau Hospital and the University of Pennsylvania, Philadelphia, Pa.

tion. It has been repeatedly shown in experiments which need not be cited here, that oxidation is diminished during anesthesia.[9] It seems highly probable that other as yet unidentified acids of partial oxidation are also produced in excess. The sum total of these acids, it is evident, will determine the amount of alkali which will be withdrawn from the available quantity in the body.

We have said that oxidation is diminished during anesthesia, having as a basis for this statement many reported experiments. Since suboxidation is the important, if not the only cause of the formation of acids during anesthesia, the prevention of these acids must be directed toward the cause of the diminished oxidation. From these same experiments and others, it can be definitely stated that *oxidation is diminished somewhere between the oxygen in the blood and the oxidizable substances in the cell. Further, interference with oxidation is so intimately associated with the anesthetic agent, that to prevent suboxidation is to prevent anesthesia. Therefore, to prevent excess acid formation is to prevent anesthesia. The protection of the patient against acidosis must therefore reside in supplying the body with alkali.* When acids resulting from anesthesia are then formed, a sufficient amount of alkali will be available to neutralize them and keep the acidosis a compensated one.

NEUTRALIZATION OF ACIDS.

A word as to the mechanism by which the body provides for the neutralization of the acids formed during anesthesia is now in place. They are treated in the same way that mild excesses of acids are treated in any other condition. We soon found that sufficient acids were produced in some cases to neutralize the entire bicarbonate of the blood.

This of course is not possible in life. *Further studies confirmed what had been demonstrated before, that the ammonia and titrable acidity of the urine were increased after anesthesia. To put it briefly, these acids are neutralized as they are formed by sodium bicarbonate and ammonia, and then probably. for we have only begun these analyses, by other available but less easily mobilized bases such as calcium, and magnesium. The salts of the acids are then excreted and thus eliminated from the body.*

SYMPTOMS OF ACIDOSIS.

The question now arises—what symptoms does acidosis of itself produce? The answer to this is clouded by the fact that an uncompensated acidosis is practically always an accompaniment of some grave pathological condition. For example, in nephritis an acidosis developes, but only in grave forms of the disease, and it is difficult to estimate the relative significance which should be attached to the acidosis and to the other conditions produced confidently. In diabetes mellitus, where this condition appears frequently enough, a trifle clearer picture can be obtained. In lower organisms and isolated cells the reaction to changes in acidity are quite sharp. All pathogenic bacteria require culture media of a definite reaction for their optimum development. The meningococcus can be easily inhibited or killed by what seem very small changes in the reaction of the medium on which it is growing. We have often observed the difference in behavior of gold fish in an aquarium, when the water was alternately made very slightly acid and very slightly alkaline. *It can with safety be said that the symptoms which acidosis of itself will produce will vary according to the degree of the condition. from mild headache and general mental dullness, to coma and death. We shall not attempt to state dogmatically in our 15 per cent. of cases who showed acidosis, what symptoms were due to that codntion, but we can state decisively, that these patients suffered more nausea and vomiting, more headache, more gas pains, and took a longer time to recuperate than did the others who showed compensated acidosis.* These comparisons, we realize, are difficult to make critically, on account of differences in individuals, in the pathology and the operative treatment. We cannot help feeling, however, that acidosis *per se* did play a part in their unfavorable postoperative symptomology; for plenty of water with alkali led to remarkably favorable change in the picture of quite a few. It remains to examine the particular cases in whom this uncompensated acidosis occurred, and to determine in what individuals and under what conditions it occurred.

CHART No. 1.

Blood CO_2 Cc. per 100 Cc.		Blood Ketones Mgms. per 100 Cc.		Differences		Theoretical Decrease in CO_2	Per Cent. Decrease From Ketones
Before	After	Before	After	CO_2	Ketones		
73.3	59.9	37.7	45.5	13.4	7.8	2.8	21
56.6	47.3	6.8	11.4	9.2	4.6	1.7	18
74.0	51.3	45.8	52.0	22.7	6.2	2.3	10
42.0	28.1	103.7	185.6	13.9	81.9	31.6	228
66.2	54.8	22.0	46.7	11.4	24.7	9.4	82

DETERMINING FACTORS OF UNCOMPENSATED ACIDOSIS.

Sex adds no particular determining factor, nor apparently does age, except possibly in the extremes. *Impaired kidney function, as would be expected, was definitely a factor.* Here there is not only the failure of excretion of acid substances, but also the possible retention of other acids not resulting directly from anesthesia. *Patients with diseases which drained the body of reserve alkali before operation, always showed large diminution in carbon dioxid,* for example, severe, long continued infectious processes, in which fever with its incerased metabolism had caused excess acidity. *The duration of anesthesia was a factor.* The longer suboxidation is allowed to proceed, the greater is the demand for reserve alkali. The deeper the anesthesia, that is, the more cells anesthetized, and the deeper they are anesthetized, the greater will be the quantity of acids produced. Preoperative preparation played its part. For example, many patients were admitted with a spreading peritonitis following appendicitis, cholecystitis, and similar acute infectious processes, and these were usually allowed to remain unoperated until the peritonitis had become more or less localized. During this period among other things, they were given no food. This in itself, tended toward acidosis. *Hemorhage has been found to reduce reserve alkali.*[10] While none of our patients were actually shocked, several showed immediate symptoms which might be referred to such a condition in a mild degree. These patients all showed more than the average diminution in bicarbonate. Results in France indicated to those investigators,[11] that *in a condition of shock there is uncompensated acidosis.* This is, of course, to be expected, for oxidation is surely interfered with in this condition. Finally, and of great importance, *those patients who show a low reserve before operation will always show a greater diminution after operation.*

THE MANAGEMENT OF ACIDOSIS.

The management of operative cases from the standpoint of acidosis is fairly simple in the light of these investigations. The interpretation that the reduction in plasma bicarbonate is due to overventilation of the lungs, and not to acids, has been discussed for reasons which are clear. The decision between the two is fundamental. It has been recommended that carbon dioxid be given with the anesthetic to make up from outside sources the carbon dioxid of inside metabolic origin, which has been lost in excess through too rapid and too deep respiration.[2] It is unnecessary to discuss here, whether the respiratory centre is stimulated by the H-ion concentration of the blood alone, or by that factor and carbon dioxid as a specific stimulant in addition to its property as an acid.[12] Suffice it to say, that the acidity of the blood is a factor in keeping the respiratory center in activity. If the carbon dioxid of the blood be diminished through excessive ventilation, and did the blood become more alkaline as a result, this normal stimulus would be diminished, and the patient stop breathing. Then it would be logical to give carbon dioxid to keep the acidity up to a given stimulating point. Since, however, other acids are formed in the body, and in excess, this treatment is not only illogical, but actually harmful. Under these circumstances, since carbon dioxid is an acid, insult would be done to injury by adding just so much more acid to that already formed.

SUMMARY.

The much discussed subject of acidosis in surgery has been investigated, and by a correlation of results of various analytic data, the following statements can be definitely made.

There is an increase of acids in every patient anesthetized by ether, chloroform, and nitrous oxid. Intraspinal anesthesia by stovaine produced quite a marked increase in acids in one case which has come under our observation. This increase does not reach a stage where true acidosis is produced in 80 per cent. of cases. In 15 to 20 per cent. of cases it does.[13]

Estimations of the bicarbonate content of the blood plasma give information of acidosis in anesthesia as well as in other conditions.

The conditons under which acidosis in anesthesia will appear have been mentioned.

CHART No. 2

Blood CO_2 Cc. per 100 Cc.		Blood Ketones Mgms. per 100 Cc.		Differences		Theoretical Decrease in CO_2
Before	After	Before	After	CO_2	Ketones	
74.0	51.3	46.4	301.8	22.7	255.4	98.5

CONCLUSIONS.

It is recommended that estimations of the bicarbonate content of the blood plasma be made freely for the comfort of operative patients. When the pathology of the patient is grave, and of long standing, when the operation is likely to be lengthy, serious one; when there is, or is likely to be hemorrhage, or when there is possibility of shock, it is not only advisable for the postoperative comfort,

but imperative for the safety of the patient that these estimations be made.

To state it dogmatically, whenever a patient before operation, shows a bicarbonate content of 58 cc. or less, alkali should be given. The use of sodium bicarbonate in this connection is well known. The question may be asked, however, if other alkalies will not serve the purpose better. There are certain possible theoretical reasons why this may be so, but no experimental knowledge is available on this point, and therefore it can not be pressed. However, it may be emphasized that too much alkali may do harm. The ease with which this can be determined, as well as the opposite condition of deficiency, renders the matter quite simple. A second analysis of the blood two hours after administration of alkali by mouth, will indicate whether the desired result has been effected.

The management of operative cases from the standpoint of acidosis can now be said, therefore, to rest on a very definite and safe foundation.

Corinthian and Girard Aves.

REFERENCES:

1. Van Slyke, D. D. and Cullen, G. E.: J. Biol. Chem., 1917, XXX. 289.
2. Henderson., Y. and Haggard, H. W.: J. Biol. Chem., 1918, XXXIII, 333 to 371.
3. Macleod, J. J. R. and Knapp, H. J.: Am. J. Physiol., 1918, XLVII, 189.
4. Reicher, K.: Z. klin. Med., 1908, LXV, 235.
5. Caldwell, G. A. and Cleveland, M.: Surg., Gynec., & Obst., 1917. XXV, 22.
6. Jeans, P. C. and Johnston, M. R.: Am. J. Dis. Child., 1917, XIV, 57.
7. Bradner, M. R. and Reimann, S. P.: Am. J. Med. Sci., CL, 1915, 727.
8. Reimann, S. P. and Bloom, G. H.: J. Biol. Chem., 1918, XXXVI, 211.
9. Alexander, F. G. and Cserna, S.: Biochem. Ztschr., 1913, LIII, 100.
   Baer, J. and Myerstein, W.: Arch. f. exp. Path. u. Pharm., 1910, LXIII, 441.
   Warburg, O.: Munch. Med. Wochschrft., 1911, LVIII, 289.
   Verworn, M.: Bull. Johns Hopkins Hosp., 1912. XXIII, 97.
   Lillie, R.: Biolog. Bull., 1916, XXX, 311.
10. Milroy, T. H.: J. Physiol., 1917, LI, 272.
11. Cannon, W. B.: J. Am. M. A., 1918, LXX, 531.
12. For discussion and experimental data on this question see Scot, R. W.: Am. J. Physiol., 1918, XLVII, 43.
13. Stovaine case: Urinary excretion of Ketones, 24-hour specimens; before operation, 0.102 gms.; after operation, 7.864 gms.

TO EXPEDITE THE PUBLICATION OF THE TRANSACTIONS OF THE SEVERAL MEETINGS THOSE WHO PRESENT PAPERS CAN MATERIALLY AID THE EDITOR BY SENDING IN ADVANCE COPIES OF THEIR CONTRIBUTIONS AT THE EARLIEST POSSIBLE MOMENT. ATTENTION TO THIS EDITORIAL COURTESY WILL HASTEN THE PUBLICATION OF PAPERS BY THREE MONTHS.

ANESTHESIA IN WAR SURGERY

DROP-ETHER PHARYNGEAL ANESTHESIA AND APPARATUS FOR ASEPTIC ANESTHESIA IN PLASTIC FACIAL SURGERY.*

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Plastic restoration of war wounds has made a new requirement of operative surgery. Sliding and turn-in flaps, bone transplants, secondary flaps and even skin grafts open tissues that are not infected. The mouth and particularly war wounds of the mouth always contain infective organisms. Newly opened tissues should, if possible, be protected from infection in these operations.

The anesthetic devices in general use have in the main proved satisfactory. In addition to conductive and local anesthesia, the chief reliance for general anesthesia has been the ordinary mask and pumps and blowers of various types and combinations.

ROUTINE METHODS OF ANESTHESIA NOT ASEPTIC.

By none of them, however, may one secure even an approximately aseptic field for operations about the mouth. None of them protect the field from mouth secretions and none of them permit the use of efficient antiseptics, for the reason that the respiratory tract is only relatively protected. An efficient antseptic like tincture of iodin, is highly irritative and dangerous in the larynx and trachea, and the exhaust pump, no matter how good, cannot be depended on absolutely to remove every drop of fluid from the pharynx. It has become the custom, consequently to regard the mouth as a region that could not be sterilized and give the well vascularized tissues such credit for resistance to infection that aseptic operations were not only possible, but not necessary. In a measure the reasons might apply to the vaginal or anal region. Before operating on these parts, thorough cleansing and sterilization of the surface with strong antiseptics is the rule and operation without such precautions would not be considered standard procedure. The failure of

* Read by proxy during the Fourth Annual Meeting of the Interstate Association of Anesthetists with the Indiana State Medical Association, Hotel Claypool, Indianapolis, Ind., Sept. 25-27, 1918.

surgeons to adopt the same method in oral operations is due to the inappropriate methods of anesthesia in general use. *The same advantages may be obtained by providing a safe airway for respiration through which the anesthetic may be given and which will securely block the larynx from blood, or antiseptics strong enough to sterilize the surface, and which will, after the site of operation has been cleansed, protect it from reinfection by the mouth secretions.*

a moveable joint. This permits the tube to be turned upward for operations involving the mouth and neck and downward for the face and head. The nasal tubes are attached to a Y tube so curved that the stem may be firmly fixed over the nose by a strip of adhesive plaster, which insures stability and prevents obstruction in kinking. The pharyngeal tube has an inside diameter of half an inch and the connecting rubber tube an inside diameter of three-quarters of an inch. A practical working

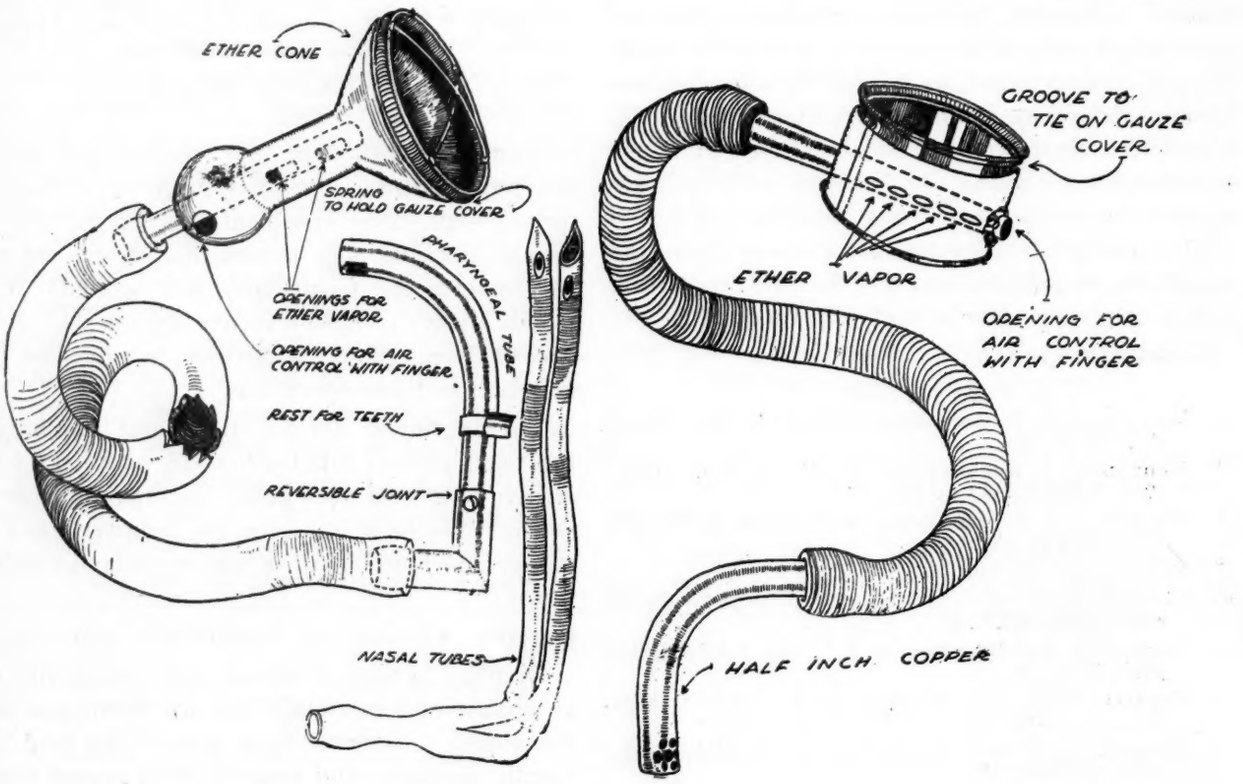


Fig. 1-2. The author's apparatus for drop-ether pharyngeal anesthesia and the war model.

THE NEWER METHOD AND APPARATUS.

Ether inhalation by mouth through a large pharyngeal tube and a coffer dam of gauze packing, when properly placed, is superior to any other method in a very large class of these cases. It furnishes that efficient block between the operative field and the respiratory tract so necessary for the performance of ideal operations in this region and makes possible a degree of asepsis in the operation, not possible by any other method. It is now over 12 years since I first adapted a curved metal tube and gauze pack to pharyngeal anesthesia by drop ether.

The inhaler I have devised for these operations consists of a curved airway adapted to the mouth and pharynx. The open and slotted end of which should be so placed that it rests just above the larynx back of the epiglottis. It is provided with

length for this tube is 30 inches. The funnel is of spun metal, provided at the top with crossed curved wires to support the gauze cover, and is surrounded by a groove in which fits a coiled string to hold the gauze in place. The inhalation tube is so far arranged that it is not possible to pour liquid ether into it. The opening to admit air directly into the inhalation tube is placed in the bulb of the handle at a convenient place for finger control.

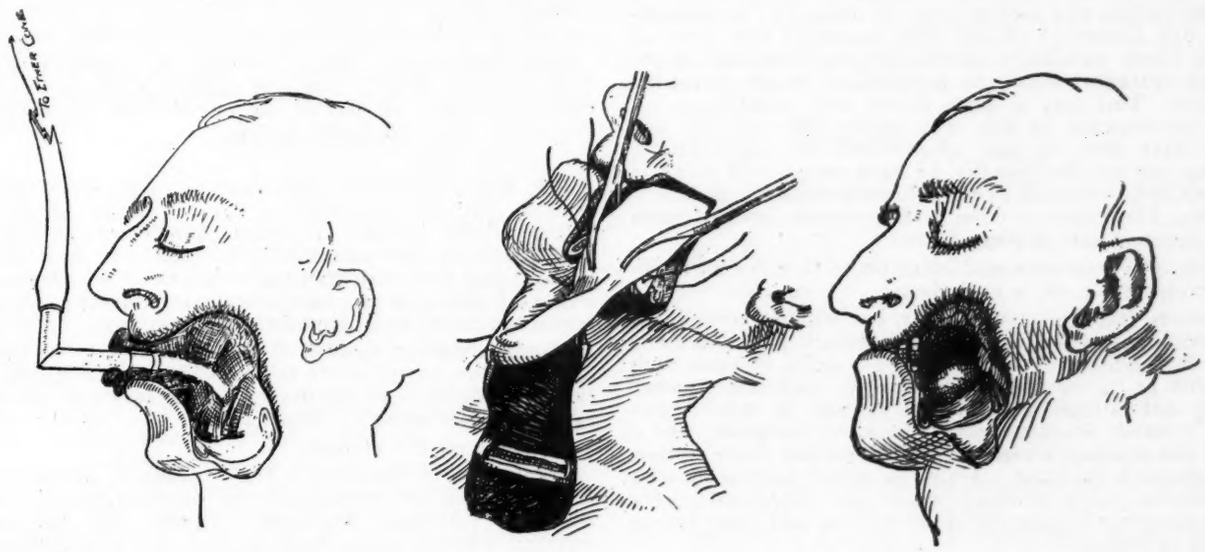
The demands of war surgery have so taxed the manufacturing resources of instrument makers that it is difficult and expensive at this time to obtain this well-finished instrument. For this reason I have designed a war model, which is made by removing the handle from a common tin drinking cup and running a groove around the top, on which to tie the gauze. The ether vapor way is made by

constructing a half-inch tin tube with five ¼-inch holes punched into the lower side. This is passed through holes in opposite sides of the cup near the bottom, leaving one end projecting about ⅛-inch to serve as a finger control of the air admixture and the other end projecting about 2½ inches on the opposite side. This end may be expanded to ¾-inch to fit the rubber tube. An airway may be made by bending a half-inch soft copper tube in the form of the original pharyngeal tube or using the rubber tube alone, in which case it must be protected by a wooden prop or mouth gag. Any of the other solid pharyngeal airways used by anesthetists make suitable substitutes. The large size of the tubes gives free movement to the air or ether vapor current, and provides for a moderate volume of rebreathed ether and air.

thoroughness and care with which this is done. The gauze pack forms the necessary dam of protection, both for the respiratory tract and for the field of operation. The inhalation tubes, either pharyngeal or nasal, may be further held in place by an adhesive strip around or over and then attached to the forehead or face as the character of the operation permits. If this is carefully done a satisfactory anesthesia may be maintained without interference.

It is essential that the ether be given by some one competent to maintain safely such a degree of anesthesia as will prevent any attempt at vomiting, which might clog or displace the tube and break the asepsis of the operating field.

These requirements, while not difficult of accomplishment, demand careful attention, but the result is certainly worth while. We may expect



Figs. 3, 4, 5. Show the pharyngeal tube in position (3), and the type of plastic facial surgery for which drop-ether pharyngeal anesthesia is adapted.

Year by year as experience has accumulated my satisfaction with the method has increased. Success may be attained only by minute attention to details. The extension of the respiratory tract across the operative field from the larynx to the ether cone requires first proper adjustment.

DETAILS OF ADMINISTRATION.

A sufficient preliminary hypodermic of morphin and atropin should be given an hour before ether is to be administered. Complete third-stage anesthesia must then be produced with the ordinary mask. The pharyngeal tube is then introduced, or in the comparatively few, in which deeper access to the mouth is required, the nasal tubes are placed. The posterior part of the mouth is then well packed with gauze. Much depends on the

safety in anesthesia, facility in operation and a degree of protection from infection that cannot be obtained by any other method.

CONCLUSIONS.

In safety the supremacy of drop ether in many thousand of cases stands unchallenged. The inhaler herewith described, gives drop ether from what is practically an open mask, as the finger of the anesthetist at all times gives an instant touch control to the air admixture. This is by no means true of an ordinary funnel. The character of the respiration, which is the great indicator of safety in narcosis, is at all times apparent to the anesthetist by the sound of conduction in the tube.

When this method was first used the principal idea was to obtain a satisfactory anesthesia in these

operations. The gauze pack in the mouth soon demonstrated the possibility of securing a degree of asepsis not possible without it.

A necessary preliminary is a careful cleaning of the mouth by the dental surgeon. Tartar should be scraped from the roots, and decayed, loose and abscessed teeth should be extracted, as should teeth within or about the diseased area. The greatest use for asepsis in these operations will be found in the reconstructive plastics that are required by war wounds of the face and jaws.

METHODS OF GENERAL ANESTHESIA IN FACIAL SURGERY.

M. WADE, M.R.C.S., L.R.C.P., LOND.

Lieutenant, Royal Army Medical Corps; Anesthetist to Queen's Hospital, Sidcup.

There are two main difficulties in anesthesia for operations on the face and lower jaw: (1) Maintenance of good airway; (2) difficulty of avoiding interference with aseptic technic and field of view of surgeon. In September, 1916, Colonel J. F. W. Silk suggested that cases in which blood was likely to find its way into the mouth during operation should be anesthetized in the sitting-up position. This was at once found very satisfactory. I have anesthetized in this way nearly 300 patients, and there have been no bad after-effects or complications. During the last five months we have endeavored to form an opinion as to which of the following methods of administering chloroform or ether to the various types of cases give the most satisfactory results.

Mode of Preparation and Induction.—This, for all methods except ether oil, is as follows:

Patients prepared in usual way, but without preliminary hypodermic injection of morphia. Atropin, gr. 1-100, half-hour before induction. I first tried a series of cases with morphia gr. ¼ in addition to atropin; and then another series with atropin alone. The patients in latter series were certainly in better condition after operation; and I could not persuade myself that induction was much quieter, with morphia injection. I always induce anesthesia with chloroform, using ordinary mask and drop-bottle, very often changing to mixture of chloroform and ether before patient is under.

The following is the technic employed in the seven methods:

IN THE LYING-DOWN POSITION.

1. *Chloroform, C.E., or ether, by Shipway's warm ether apparatus.*

When patient is under, a small-size Hewitt's airway is introduced into mouth, then a small, bent metal tube is connected to rubber tube from Shipway apparatus. End of metal tube is placed just inside mouth of Hewitt's airway. By this means it is possible, in majority of cases, to use a mixture of chloroform and ether and to keep patient under with one compression of bulb in every three or four inspirations. The anesthetist sits at one or other side of operating table, and, if necessary, can hold up patient's chin with one hand beneath towels, while having other hand free to work bulb of apparatus.

This method is useful for short operations when airway is good, and not likely to be interfered with by blood and mucus. It can be used in such operations as eye plastics, cheek plastics (not involving oral cavity), epithelial inlays.

Contra-indications.—Plastics involving oral or nasal cavities. Operations on jaw (owing to possibility of interference with aseptic technic).

2. *Sterile anesthetic.*

This method was especially devised for such operations as wiring and bone-grafts in lower jaw. When patient is under the anesthetist washes up in exactly same way as surgeon, while someone else carries on with anesthetic. When necessary preparation of site of operation has been completed the anesthetist, in sterile face-mask, gown, and gloves, continues anesthetic with sterilized drop-bottle and mask. The mask is held in position beneath towels in one hand, and chloroform or C. E. dropped on to upper surface of towel with other. The hands may not be changed during operation.

In these cases the jaws are firmly splinted together in closed bite position. I have never experienced any trouble from tongue falling back; laryngotomy instruments are always ready, but it has never been necessary to use them. Lately our dental surgeons have fitted splints which are joined together with screws, so that in cases of emergency the jaws can easily be separated.

3. *Intra'racheal administration of warmed ether vapor.*

Owing to necessity for economy in ether it is not justifiable to use the open-ether method of induction in these cases, although I believe it to be the best. I think the catheter is more easily passed by the direct method with patient's head and shoulders on same level—i. e., without having the shoulders raised, as is sometimes done.

This method is particularly useful for plastics involving the nasal and buccal cavities.

Contra-indications.—1. Contracted mandibular arch through loss of bone. 2. Trismus from various causes. 3. Jaws splinted together. 4. Contracted mouths from gunshot wounds or burns. 5. Extensive lip plastics on account of interference with surgeon's manipulations.

Disadvantages.—1. Blood frothing up during respiration, especially in intra-oral and palate operations. 2. Occasional spasms of larynx on introduction of catheter (probably owing to faulty technic).

4. *Kahn's tube.*

This is useful for the same sort of cases as the intratracheal, with the exception of any lip plastics where its bulk precludes its use. In cases complicated by loss of bone in lower jaw where it is impossible to pass intratracheal catheter, this instrument is available either as a means of giving the anesthetic, or merely to act as an airway when ether oil is administered per rectum.

Disadvantages of technic.—1. The larynx may be small. 2. Possibility of injury to larynx. Great care should be exercised during introduction. I have seen one or two cases of slight laryngitis after its use.

5. *Ether oil per rectum.*

Preliminary Preparation.—These patients should have saline aperient on morning of day previous to operation, also dose of castor oil same evening. The following morning a simple enema is given, and rectum well washed out. A hypodermic injection of hyoscine gr. 1-100, morphin gr. ¼, atropin gr. 1-150, should be given half-hour before patient is brought to theater, when the ether oil is immediately injected in a quiet and darkened anesthetic-room as nearly as possible one hour before operation is timed to start.

I have tried two mixtures: (1) Ether 6 oz., olive oil 2 oz.; (2) ether 5 oz., olive oil 2 oz., paraldehyde 2 dr., and have come to the conclusion that the second gives the better results. The mixture is run in slowly through a funnel and tube attached to a soft rubber catheter. Catheter must not be passed more than four or five inches into rectum. Patients complain of less discomfort, if mixture be slightly warmed before introduction. I have only had one case in which injection was not retained.

If necessary, it is better to give chloroform or C. E. rather than ether as additional in these cases. If ether alone is given patient is more likely to have some bronchitis as after-complication; this applies especially to operations lasting for two hours or longer.

Immediately on patient's arrival back to ward rectum is very thoroughly washed out with warm water until no smell of ether can be detected, and no drops of oil seen in wash-out. I have noticed that after long operations (over two hours) there has been some intestinal paralysis, which causes difficulty in washing out rectum, and subsequent abdominal distension and constipation. These effects are best treated by a hypodermic injection of pituitrin ½-1 c.cm.

There is no doubt that this is a very valuable method of anesthesia for many operations in plastic surgery.

This is owing to its adaptability to surgeon's convenience during operation and on account of comparatively mild after-effect to patient. Another point in its favor is that airway is very rarely obstructed by tongue.

With regard to after-effects, the great drawback is length of time that patients take in coming round from anesthetic. This may be anything from two to four hours. But, on the other hand, vomiting is either absent, or only occurs once or twice; and patients themselves feel better than after an ordinary anesthetic. As to local complications in rectum, in a series of 100 cases there have been two patients who had slight bleeding and a few have complained of pain for two or three days afterwards. So far there have been no cases of proctitis.

This method is practically suitable for the following cases:

(1) *Bone Operations on Lower Jaw.*—(*a*) Because anesthetist does not interfere with surgeon; (*b*) vomiting is very distressing for patient who has had part of one of his ribs removed; (*c*) on account of length of operation.

(2) *Cartilage Implantations* when portion of rib cartilage is removed.

(3) *Very Long Plastic Operations* (e. g., for extensive burns); there is less shock.

(4) Cases which, from previous experience, are known to suffer from excessive vomiting after other methods.

Contra-indications.—Operations where blood is likely to find its way into pharynx, except when this can be prevented by introducing a post-nasal plug or Kahn's tube and packing.

IN THE SITTING-UP POSITION.

(A) *Chloroform or C. E. and oxygen by Shipway's warm ether apparatus.*

This was the method advised by Colonel Silk in September, 1916, and the technic is as follows:

An operating table must be obtained which will allow of head-piece being raised almost to perpendicular to form "back" of chair. To top of this can be fixed some kind of adjustable head-rest, to which the patient's head can be bound with flannel bandage. Patient sits on table and induction is carried out with mask and drop-bottle. When patient is under, his head is firmly bound to head-rest and anesthetic is then continued as follows:

An oxygen cylinder is connected by means of rubber tube to one arm of Y-shaped metal connection. To other arm is attached hand bulb belonging to Shipway warm ether apparatus, and from stem of the Y a rubber tube conveys either oxygen or air to Shipway apparatus. This arrangement economizes use of oxygen. If patient shows signs of coming round during operation, amount of anesthetic may be increased by passing air as well as oxygen through apparatus by means of hand bulb. The oxygen is allowed to bubble through chloroform or chloroform and ether at required rate.

The mixture of anesthetic vapor and oxygen is led to patient through piece of rubber tubing sufficiently long to reach from level of ordinary anesthetic table to top of patient's head; to latter end of tubing is attached No. 10 soft rubber catheter, which either is passed down one or other of nasal passages as far as upper part of pharynx, or, local conditions rendering this impracticable, it may be introduced into mouth through suitable metal tube.

Patients anesthetized in this position seem to require less anesthetic than when lying down. There is a risk of their vomiting during operation, and occasionally they have to be let down owing to faintness; both these are very exceptional. This position increases physical strain on surgeon, but on the other hand, it has three great advantages. It gives him an excellent view of patient's features; there is less bleeding, and, in the very large majority of cases, he has no anxiety concerning airway.

Long operations are no contra-indication to this position. I have had many lasting three hours, and one just over four, and the patients have nearly all been in good condition when operations were finished and did not suffer from any bad after-effects.

This method of anesthesia is particularly suitable for large plastic operations on lips and cheek plastics involving mouth. It is also useful where there is great loss of bone in mandibular arch.

(B) *Ether oil per rectum.*

The preparation and induction are exactly the same as in Method 5 above. The patient is placed on operating table on his back. Care should be taken to ascertain that he is well under, otherwise some additional anesthetic should be administered by means of mask. When required depth of anesthesia is reached "back" of table is raised to perpendicular by easy stages. Additional anesthetic, if required, is given in same way as above (sitting-up position, A). I have only tried it four times, but although results in these cases were quite satisfactory, I cannot yet say whether it has any great advantages.

SUMMARY.

From the anesthetist's point of view plastic operations may be divided into two main groups: those in which blood finds its way into the airway, and those in which it does not. I have endeavored in the following table to give a list of the various types of operations, together with the method of administration which we consider suitable for each case. Where there are alternatives the first is preferable:

Types of Operations.	*Methods of Anesthesia.*
Eye plastics	Chloroform or C. E. Shipway.
Eye plastice with cartilage implantations	Chloroform or C. E. Shipway. Ether-Oil.
Nose plastics—	
(*a*) Cartilage implantation, forehead	Ether-Oil.
(*b*) Bringing down nose	Ether-Oil, intratracheal.
(*c*) Where nasal cavity is involved	Ether-Oil, Kahn's tube.
(*d*) Where nasal cavity is not involved	Chloroform or C. E. Shipway.
Lip plastics	C. or C. E. and oxygen, sitting up. Intratracheal. Ether-Oil, sitting up.
Cheek plastics—	
(*a*) Involving oral cavity	Intratracheal. C. or C. E. and oxygen, sitting up. Ether-Oil, sitting up.
(*b*) Not involving oral cavity	Chloroform or C. E. Shipway.
Chin plastics	Intratracheal. Kahn's tube.
Jaw operations—	
(*a*) Wiring fractures	Ether-Oil. Sterile anesthetic.
(*b*) Bone graft	Ether-Oil. Sterile anesthetic.
(*c*) Either of above with jaws splinted together.	Sterile anesthetic.
Extensive burns of face	Ether-Oil.

THE INTERSTATE ANESTHETISTS MOTTO FOR 1919 IS THE FOLLOWING:

AVOID THE EASY, LAZY JOB. SHUN THE POSITION THAT CALLS FOR LITTLE OR NO EXERTION, THAT DOES NOT PUT YOUR POWERS TO THE TEST, THAT DOES NOT KEEP YOU CONSTANTLY ON TIP-TOE, IN AN EFFORT TO FILL IT WELL—BETTER, IN FACT, THAN IT WAS EVER FILLED BEFORE. DON'T RUN AWAY FROM DIFFICULTIES, FROM HARD WORK, FROM HARD KNOCKS, IF NEED BE. HAMMERING HARDENS AND STRENGTHENS A MAN. IT TESTS HIS METTLE, IT DEVELOPS HIM. IT TEACHES HIM SELF-RELIANCE, SELF-CONFIDENCE, GRIT. IT DRUMS OUT COWARDICE OR TIMIDNESS AND MAKES HIM UNAFRAID TO STAND UP AND FIGHT UNTIL HE LEARNS HOW TO WIN OUT.—DOLLAR.

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F. HOEFFER McMECHAN, A.M., M.D., *Editor*

Avon Lake, Ohio, U.S.A.

JULY EDITORIALS. 1919

SUGAR IN RELATION TO OPERATION AND ANESTHESIA.

P. J. Flagg has drawn attention to the value of candy in the pre- and postoperative dietary of patients coming to operation under anesthesia.

Litchfield, speaking before the A. M. A., at its last session, claimed that the intravenous injection of dextrose overcomes dehydration, intoxication and nitrogen starvation. Dehydration occurs in vomiting, diarrhea, hemorrhage, acidosis, inflammatory exudation, dysentary and cholera and in these conditions in which the symptoms are most striking the injection of dextrose changes the whole clinical picture. Patients who are desparately ill, frequently recover promptly after a single injection of from 400 to 500 cc. of a solution of dextrose.

Litchfield uses a 25 per cent. isotonic solution of dextrose where he previously used normal saline, especially in pneumonia, purulent pericarditis, meningitis, alcoholic intoxication, in surgical cases, pre- and postoperatively, in vomiting and in acidosis. The technic is that of salvarsan injection. As much as 1,700 cc. has been given in 11 hours, but one hour's time should be consumed in injecting 200 cc., or sharp reactions may occur. Other conditions demanding the use of dextrose are acetonuria, the toxemias of pregnancy and the puerperium as well as delayed chloroform poisoning.

Piper commends the use of glucose solution with a little alcohol as a rectal injection in shock and intravenously, without the alcohol, in severe hemorrhage.

Now, who will check-up on this matter and present a series of clinical observations on the value of sugar therapy in relation to operation and anesthesia?—McM.

THE NURSE ANESTHETIST IN OHIO.

The present General Assembly of Ohio has seen fit to legalize the "administration of anesthetics by registered nurses, properly trained in recognized hospitals, under the direction and supervision of a licensed and qualified physician."

Thus supervised anesthesia by anesthetist technicians now has the endorsement of law, although this pernicious legislation was opposed by all those having the interests of anesthesia as a specialty at heart.

Those behind the passage of this legislation are the surgeons and hospitals who are exploiting nurses as cheap, scab labor. They also represent a clique within the profession and hospital associations, who are precipitating the practice of medicine into socialized medicine under hospital domination.

Presently the profession-at-large will realize the fact that it has been sold-out by supposedly altruistic leaders and when the revulsion against them comes it is to be hoped that they will be relegated to the oblivion they so richly deserve for betraying the long fight for betterment in the practice of medicine and especially in the development of the newer specialties.

When these same altruists come to operation it is to be hoped they will receive a dose of the same sort of anesthesia they are now legalizing.—McM.

SEATTLE ASSOCIATION OF ANESTHETISTS.

Some fifteen interested physicians have recently organized the Seattle Association of Anesthetists with the following specialists as officers: President, Dr. Windsor A. Brown; Vice-President, Dr. Louis H. Maxson; Secretary-Treasurer, Dr. Samuel Stusser.

This movement spells progress for the specialty of anesthesia in the northwest and it is to be hoped that the organization of Seattle and vicinity is the initial step in organizing the Pacific Coast anesthetists into a large and influential association. The SUPPLEMENT and the other associations of anesthetists offer their congratulations and best wishes for success to the Seattle Association. Those wishing to join this new association should get in touch with Dr. Samuel Stusser, 514 Leary Bldg., Seattle, Wash.

Society Proceedings

Membership in a society devoted to your specialty is an essential to success.

INTERSTATE ASSOCIATION OF ANESTHETISTS —FIFTH ANNUAL MEETING.

The Interstate Association of Anesthetists has been accorded the distinction of a Joint Meeting with the American Association of Gynecologists and Obstetricians. This Fifth Annual Meeting will be held at Cincinnati, Ohio, September 15-17, at the Hotel Gibson, where the Interstate was organized in 1915.

A Joint Session will be devoted to papers of mutual interest, among them the following:

Safety Factors in the Team-Work of Operator and Anesthetist, John J. Buettner, M.D., Syracuse, N. Y. (Chairman's Address.)

The Value of Blood Pressure as a Guide Before, During and After Operation, E. I. McKesson, M.D. and Chas. Moots, M.D., Toledo, O.

Some Practical Points in Gas-Oxygen Obstetrical Analgesia and Anesthesia, A. E. Guedel, M.D., Indianapolis, Ind. Discussion and film demonstration, C. E. Turner, M.D., Columbus, O.

Some Adjuncts for Facilitating Local and Regional Anesthesia for Major Surgery, R. E. Farr, M.D., Minneapolis, Minn. (Film demonstration.)

Which Solution for Intravenous Injection in Shock?, Jos. Erlanger, M.D., St. Louis, Mo.

A special effort is also being made to hold an outstanding Section on Anesthesia for Oral Surgery and Dentistry and the following papers have so far been scheduled:

Somnoform, a Neglected Anesthetic for Oral Surgery, Oel E. Lanphear, D.D.S., Kalamazoo, Mich.

Nitrous Oxid-Oxygen Anesthesia in Dentistry and Oral Surgery, J. P. Henahan, D.D.S., Cleveland, O.

Some Observations on General Anesthesia for Oral Surgery, C. H. Burmeister, D.D.S., Cincinnati, O. (Lantern demonstration.)

Interested surgeons, dentists and anesthetists are cordially invited to attend and find out how the Interstate meets their needs for progress.

The following nominations have been made for 1920: Chairman, W. I. Jones, D.D.S., Columbus, O.; Vice-Chairman, Samuel Johnston, M.D., Toronto, Canada; Secretary-Treasurer, F. H. McMechan, M.D., Avon Lake, O.; Executive Committee, Alex S. McCormick, M.D., Akron, O.; John H Evans, M.D., Buffalo, N. Y.; Marie Kast, M.D., Indianapolis, Ind.; A. E. Smith, D.D.S., M.D., Chicago, Ill.; Ralph M. Waters, M.D., Sioux City, Iowa, and Roy S. Hopkinson, D.D.S., Milwaukee, Wis. Members are requested to submit further nominations.

The Annual Dinner will be served at the Hotel Gibson at 6:30 o'clock on the evening of September 15. A large attendance is expected so make your reservations early. As usual the visiting ladies will be delightfully entertained, so bring along your women folks.

Bring in at least one new member and don't overlook sending in your check for dues so that your Membership Card can be sent you in advance of the meeting. If you have a paper to present get in touch with the Secretary at once so that it can be scheduled. Don't hesitate to give the Interstate the benefit of your experiences and researches.

For further particulars address F. H. McMechan, M.D., Secretary, Avon Lake, O.

AMERICAN ASSOCIATION OF ANESTHETISTS SEVENTH ANNUAL MEETING.

The American Association of Anesthetists held its Seventh Annual Meeting at The Breakers, Atlantic City, June 9-10, 1919. Dr. Jos. E. Lumbard, vice-president, called the meeting to order and presided during the executive session. The minutes of the 1918 meeting at Chicago and the secretary-treasurer's report were accepted as read.

The following officers were elected for the ensuing year: President, Albert H. Miller, Providence, R. I.; vice-presidents, W. T. Shannon, Detroit, Mich., and Frances Haines, Chicago, Ill.; secretary-treasurer, F. H. McMechan, Avon Lake, O.; members of executive committee, Robert L. Charles, Denver, Col., and Wm. H. Long, Louisville, Ky.

The following were elected to membership: W. T. Bailey, Boston; Anna L. Bartholomew, Chicago; Edward W. Beach, Philadelphia; Philip E. Brundage, Grantwood, N. J.; Emmett J. Craig, Kansas City; W. F. Curran, Waco, Texas; W. T. Doran, New York City; James M. Gates, New York City; Wm. G. Hepburn, Westmount, Canada; F. Elmore Hubbard, Montclair, N. J.; H. W. Kearney, Washington, D. C.; Bella Lewinson, Erie, Pa.; Arnold J. Mackay, New York City; J. R. McCurdy, Pittsburgh; George Piness, Los Angeles; John W. Rayhill, Utica, N. Y.; Boris Rapoport, Dorchester, Mass.; Claude E. Richmond, Colorado Springs; C. La Rocque, Montreal, Canada; Arthur E. Smith, Chicago, Ill.; Wm. S. Sykes, Cleveland, O.; Harold G. Walker, Wyckoff, N. Y.; Thos. A. Young, Toledo, O.

The Constitution was amended so as to admit prominent dentists, specializing in anesthesia to membership.

The secretary-treasurer was voted an appropriation of $125.00.

Dr. Jos. E. Lumbard presided during the first Scientific Session and papers were presented by Drs. S. P. Reimann, Philadelphia; Wm. deB. MacNider, Chapel Hill, N. C.; Frank C. Mann, Rochester, Minn.; Fenton B. Turck, New York City; F. L. Richardson, Boston, Mass.

Dr. Wm. B. Howell, President, presided at the remaining Scientific Sessions during which the following presented papers: Drs. Jos. E. Lumbard, New York City; Albert H. Miller, Providence, R. I.; A. W. Adson, Rochester, Minn.; H. Clifton Luke, New York City; Frank Dyer Sanger, Baltimore, Md.; W. G. Hepburn, Montreal, Canada; Wm. B. Howell, Montreal, Canada; Howard Lilienthal, New York City; Walter B. Cannon, Boston; Frances Haines, Chicago; W. T. Shannon, Detroit, and W. S. Sykes, Cleveland, O.

The papers devoted to anesthesia for war surgery were especially enjoyed, as were the films and slides of Lt. Com. Seaman Bainbridge, who was the after-dinner speaker. The annual dinner was served by The Breakers, and was well attended and enjoyed by all.

As is customary the American Association of Anesthetists will meet the first two days of A. M. A. week in New Orleans, La., June, 1920. This will be the first meeting of anesthetists in the south and it is hoped that southern anesthetists will take especial interest in making it a success. Those interested in becoming members or in presenting papers are requested to get in touch with F. H. McMechan, M. D., secretary, Avon Lake, Ohio.

NEW YORK SOCIETY OF ANESTHETISTS.

The following excerpt from the *New York Times*, Sunday, May 25, 1919, is of pertinent interest to all specialists in anesthesia:

The restriction of the administration of anesthesia to licensed physicians and the exclusion of nurses from doing such work during surgical operations was urged yesterday by James Taylor Lewis, counsel for the New York State Medical Society. On the ground that the law prohibits any one without a doctor's license from giving ether or chloroform or other poisonous gas to a patient, except when directly and continuously supervised by a physician, Mr. Lewis held that criminal action should be brought to prevent the continuation of this practice in certain hospitals, as not only was the law being violated, but lives were continually being placed in danger. If it could be shown that nurses, after special training, were competent to administer anesthetics, then, he contended, the law would have to be changed so as to give the nurse the right to do the work under the proper restrictions. Mr. Lewis recently read a paper on this subject before the New York Society of Anesthetists.

After paying tribute to the importance of the nurse in the treatment of disease, Mr. Lewis showed that nevertheless there were elements concerned in the giving of

anesthetics that made it a phase of the practice of medicine as defined by the law. He then quoted the section of the public health law (Article 8, Sec. 160, subdiv. 7:)

"A person who practices medicine within the meaning of this article, except as hereinafter stated, who holds himself out as being able to diagnose, treat, operate, or prescribe for any human disease, pain, injury, deformity or physical condition, and who shall either offer or undertake, by any means or method, to diagnose, treat, operate or prescribe for any human disease, pain, injury, deformity or physical condition.

Mr. Lewis then pointed out how, in his opinion, the nurse in administering an anesthetic, did something more than place the cone over the patient's mouth, and that she had other duties which came within the definition of practicing medicine. "The nurse who gives the anesthetic and sits with the cone over the face and the unconscious patient is required to go much further. It is her duty to keep the tongue up, to watch the pulse, to pass upon the strength of the pulse, its quality, the color of the lips, the color of the skin, the condition of the skin; indeed, many other symptoms which indicate the then present physical condition of the patient to whom she is administering the anesthetic. If that is not even diagnosing the presence or absence of a disease, perhaps, then, the definition as described in our own statute means nothing.

"The operating surgeon can give no attention to the effects of the anesthetic, and if the nurse notices symptoms which seem to indicate that the patient is 'going bad' the responsibility of taking action is hers, and she must prescribe. Because some great surgeon has a woman nurse who has given an anesthetic to an enormous number of patients, and is now qualified, has no relationship to the question. Because a few nurses, through large experience, have acquired skill furnishes a poor reason for saying that all nurses, however qualified, may calmly walk into a hospital, even as a nurse on probation, or a pupil nurse, and proceed with administering an anesthetic, putting in danger the life of the patient. I am convinced that any hospital sued under such circumstances might be mulcted in damages for negligence in not furnishing qualified employees and agents in the administration of their affairs."

Mr. Lewis cited the statutes and court decisions in a number of other States, and especially that of Judge Kirby in Kentucky, in which the court said: "Dr. Frank and other physicians employing trained nurses say that in so doing they assume the responsibility. Where the trained nurse is known to them to be competent they may take the responsibility, but it is a responsibility the extent of which they probably have not duly considered. In a suit growing out of the death of a patient where the surgeon had voluntarily employed an anesthetist who was not licensed, he would in the event of his brother physicians testifying in this case certainly be held responsible."

"If a doctor," continued Mr. Lewis, "operating in a hospital in the City of New York or elsewhere, allows a nurse to administer an anesthetic, of whose knowledge he knows nothing, and of whose ability as an anesthetist he is uninformed, he must expect to be held responsible for any untoward result which ensues by reason of the giving of the anesthetic. The hospital, in turn, must be held responsible if it permits unsupervised and inexperienced women to give anesthetics, whether they be graduate or pupil nurses, because the employment of such inexperienced persons cannot be pleaded by them as a bar to an action against such institution where damage or death ensues."

Quarterly Index

ANALGESIA FOR INOPERABLE CANCER. J. Blanc Fortacin. Revista de Medicine y Cirurgia Practicas, Madrid, January 21, 1919; Vol. 122, No. 1539.

ANESTHESIA, DEPARTMENT OF, AT ROYAL VICTORIA HOSPITAL. Wm. B. Howell, Montreal. Modern Hospital, April, 1919.

ANESTHESIA FOR OPERATIONS OF THE FACE AND NECK. L. Dufourmental. Presse Medicale, February 13, 1919.

ANESTHETICS, COMPARATIVE STUDIES OF EFFACTS ON RESPIRATION. W. J. V. Osterhout. EFFECTS OF ETHER ON RESPIRATION. F. G. Gustafson. EFFECTS OF ETHER ON RESPIRATION OF BACTERIA. M. M. Brooks. EFFECTS OF ETHER ON RESPIRATION OF WHEAT. H. S. Thomas. EFFECTS OF ETHER ON CARBON DIOXID OUTPUT. M. Irwin, Cambridge, Mass. Journal of General Physiology, November, 1918.

CAUDAL ANESTHESIA. G. H. Hodgson, Tampa, Fla. Florida Medical Association Journal, February, 1919.

CHLOROFORM, ON THE ADRENALS, ACTION OF. V. Aloi. Riforma Medica. December 4, 1918.

CHLOROFORM ANESTHESIA, ON TUBERCULOSIS, EFFECTS OF. E. Olivares. Revista Medica, December 15, 1918.

ETHER AS AN ANESTHETIC. J. B. Holyrod. Indian Medical Gazette, February, 1919.

ETHER HYPERGLYCEMIA, EFFECTS OF ATROPIN ON. E. L. Ross, Chicago. Journal of Pharmacology and Experimental Therapeutics, February, 1919.

ETHER HYPERGLYCEMIA, MECHANISM OF. R. W. Keeton, Urbana and E. L. Ross, Chicago. American Journal of Physiology, March 1, 1919.

ETHER-OIL COLONIC ANESTHESIA FOR OPERATIONS ON THE EAR, NOSE AND THROAT IN CHILDREN. A. Hinojar, Archivos Espanoles de Pediatria, Madrid, November, 1918; Vol. 2, No. 13.

HEART MASSAGE, NEW TECHNIC FOR, UNDER CHLOROFORM ANESTHESIA; WITH CASE OF RESUSCITATION. T. C. Bost. Indian Medical Gazette, February, 1919.

LOCAL ANESTHESIA IN MASTOID OPERATIONS. H. B. Orton. Annals Otology, Rhinology and Laryngology, December, 1918.

LOCAL ANESTHESIA, REGIONAL FOR AMPUTATION OF THE BREAST. G. Labat. Presse Medicale, January 9, 1919.

LOCAL ANESTHESIA: TECHNIC IN SURGICAL INTERVENTION ON FRONTAL AND MAXILLARE SINUSES. G. Canuyt, Bordeaux and J. Rozier, Pau, France. Annals Otology, Rhinology and Laryngology, December, 1918.

LOCAL ANESTHESIA FOR RESECTION OF THE NASAL SEPTUM. E. R. Arellano. Vida Nueva, Havana, February, 1919; Vol. 11, No. 2.

LOCAL ANESTHESIA, RECTAL SURGERY UNDER. R. E. Farr Minneapolis. Minnesota Medicine, April, 1919.

LOCAL ANESTHESIA, SECONDARY SUTURE AND SKIN GRAFT UNDER. J. A. Miller, New York City. New York Medical Journal, May 3, 1919.

LOCAL AND REGIONAL ANESTHESIA. J. de Mendonca. Brazil Medico, Rio de Janeiro, March 1, 1919; Vol. 33, Nos. 7 and 9.

LOCAL ANESTHETIC, NEW; PHARMACOLOGICAL ACTION OF ALLOCAIN. S. S. Kukota, Mukden, Japan. Journal of Pharmacology and Experimental Therapeutics, February, 1919.

MAGNESIUM SALTS, GENERAL REVIEW OF THEIR NARCOTIC ACTION. H. C. Gram. Hospitalstidende, Copenhagen, March 5, 1919; Vol. 62, No. 10.

NITROUS OXID-OXYGEN ANESTHESIA IN MAJOR SURGERY. F. K. Camp, Oklahoma City. Southwest Journal of Medicine and Surgery, March, 1919.

POSTOPERATIVE ANALGESIA. B. Van Hoosen, Chicago. Boston Medical and Surgical Journal, May 15, 1919.

SCOPOLAMIN-MORPHIN IN LABOR. A. G. H. Colquhoun. Medical Journal of Australia, March 8, 1919.

SCOPOLAMIN-MORPHIN IN WAR SURGERY. C. W. Strobell, New York. Medical Record, April 26th, 1919.

SPINAL ANESTHESIA. H Frank. Deutsche Medicinische Wochenschrift, January 9, 1919; Vol. 45, No. 2.

SPINAL ANESTHESIA. H. L. Rocher. Journal de Medicine de Bordeaux, January 15, 1919; Vol. 90, No. 1.

SPINAL ANESTHESIA WITH PROCAIN. Riche. Bulletin de l'Academie de Medicine, Paris, January 21, 1919; Vol. 80, No. 3.

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A PLEA FOR CHLOROFORM.*

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The pendulum of medical opinion generally swings from one extreme to another before coming to rest in the position which experience ultimately justifies. This is particularly true regarding chloroform. From being used too much it has, in many clinics, especially in this country, been completely abandoned. In others, it is used so rarely, that those who are called upon to administer it, however proficient with other anesthetics, have not the experience necessary to use it to the fullest advantage. It is an easy step from using it only occasionally to forgetting its existence altogether. No doubt ether or nitrous oxid and oxygen can be used for every type of case requiring general anesthesia, but this does not prove that in certain conditions chloroform will not be found more useful than either. We must not be content with *good enough* but only with the best, and if we are to attain this we must define exactly the sphere of its usefulness.

CHLOROFORM IN WAR SURGERY.

The war will have put chloroform in a new light to many of those who gave anesthetics in the Military Hospitals abroad. Whether from climatic conditions or a difference in the quality of the ether supplied, or possibly owing to the special type of patient, most of them being given to smoking cigarettes to excess, ether alone was not as satisfactory as it is in this country and many anesthetists were glad to turn to the free use of chloroform. It is not intended to suggest that there is any serious tendency to establish chloroform as the routine anesthetic in these northern latitudes, but a certain familiarity with it having been obtained, it will be realized by many of us that we have allowed it to fall into somewhat unmerited neglect. It is undoubtedly more dangerous than ether, and therefore the less it is used by those who only occasionally give anesthetics, the better. It is for those who are qualified by experience with other anesthetics and whose ambition it is to reduce to the utmost that part of the suffering of the patient which may be referred to the anesthetic, to make judicious use of an agent which in its proper sphere is in the highest degree useful.

The majority of soldiers who came to operation were only slightly wounded and were, apart from the wound, in excellent physical condition. They were highly resistant to ether employed alone and very frequently shouted and struggled. Even after his return to this side of the Atlantic the soldier requires more ether than the average civilian.

Where the necessary equipment and supplies can be obtained in Military hospitals, the difficulties in inducing anesthesia with ether can be overcome by the preliminary use of nitrous oxid or ethyl chlorid. But where there is a large number of soldiers to be anesthetized, nitrous oxid and ethyl chlorid may not be obtainable, and then the value of chloroform becomes most apparent. It is, of course, better that ether should be used when the anesthetist is inexperienced and perhaps not particularly interested in this work, but with care and skill the dangers of chloroform can be reduced to a minimum, with a great saving of time and discomfort.

THE VALUE OF DOSIMETRIC ADMINISTRATION.

One difficulty in appreciating the significance of a death under chloroform is the lack of particulars given in reports as to the experience of the anesthetist and the amount of care taken by him. If he is carelessly pouring unknown amounts, at irregular intervals, on a cotton mask, and part of his attention is directed to watching the operation, he can do an astonishing amount to give choloroform a bad name where it may really not be merited.

It seems reasonable to require that with so potent an agent as chloroform, we should be able to control exactly the amount the patient is getting and that we should be able to evenly increase the dosage during the period of induction and continue it uniformly during the period of maintenance. These requirements can be attained by the use of a dosimetric inhaler such as that devised by Vernon Harcourt. When giving chloroform on an open mask, one is often made uneasy by symptoms of apparent danger and is at times puzzled to know just how deeply the patient is anesthetized. When using the Vernon Harcourt inhaler in France I was greatly struck by the absence of these symptoms and I was very rarely, if ever, in any doubt as to the depth of anesthesia. It is not enough, however, to use a dosimetric inhaler to ensure absolute safety. There have been deaths with it even in skilful hands, but it is undoubtedly a means to eliminate part of the danger. Levy's investigations of ventricular fibrillation as the usual cause of death under chloroform are worth the most careful study. The evidence he adduces to prove that the most dangerous time is that of light anesthesia is too strong to be ignored. It should teach us to hasten, as far as possible, the stage of induction, to insist that there is no hurry in commencing the operation, and to resist the

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temptation to keep the anesthesia as light as is consistent with keeping the patient quiet.

Hewitt in his directions as to the use of the Vernon Harcourt inhaler says: "It is generally found that beginning with the pointer at .2 and moving it toward the chloroform bottle at the rate of one division about every half minute up to 1.6 and 1.8 produces narcosis as quickly as is desirable." By following these directions it will take from 3 to 3½ minutes before the patient is breathing vapor containing 1.6 or 1.8 per cent. of chloroform. In view of Levy's work it seems safe to push the indicator up to 2 and give a vapor of 2 per cent. by the end of a minute, and this can be done without discomfort to the patient.

In line with Levy's theory is the fact that where chloroform is used as the routine anesthetic it is always given lavishly and there is a comparatively low death rate.

The Concomitant Use of Morphin, Oxygen and Warmed Vapor.

It is not only fear upon the part of the patient which predisposes to death under chloroform but fear upon the part of the anesthetist. *Levy's statement that atropin by throwing the vagi out of action predisposes to ventricular fibrillation, should be borne in mind. There is not the same need for atropin with chloroform as there is with ether, as there is not the same excessive salivary secretion.* It seems reasonable, however, to use morphin alone as it lessens fear and struggling.

Gwathmey has urged the importance of using oxygen with chloroform. Since the blood leaving the lungs, when ordinary air is breathed, is nearly saturated with oxygen, lacking only one volume per cent. of complete saturation, it is hard to see how an extra 1 per cent. can make much difference except in the case of patients whose respirations are feeble or obstructed. Physiologists deny that breathing pure oxygen has any effect on oxidation in the resting body. Possibly, however, it may have some effect apart from oxidation. *In certain cases where abdominal rigidity persists under deep ether anesthesia with a good color, the breathing of oxygen will often produce quick relaxation.*

Gwathmey also states that warming chloroform vapor enhances its safety. Whatever the method of administration, except in the case of intratracheal or intrapharyngeal insufflation, the inspired air with its contained vapor has been warmed to the temperature of the body before it reaches the alveoli of the lung where absorption takes place. If the patient is breathing through his nose the inspired air is warmed to the temperature of the body before it even reaches the glottis. It is difficult to see how the act of warming air laden with 2 per cent. of chloroform or less by the nose can be detrimental to the body. In the case of ether it is certainly possible to deliver ether vapor at or below the temperature of the room through an intratracheal catheter without the type of anesthesia being apparently different from that due to warmed vapor. If there is any advantage in warming chloroform, may it not be due to some chemical change caused in the chloroform by the heat? Recently the work of Cotton of Toronto on the chemistry of ether has opened up new possibilities. May it not be that somewhat similar discoveries may be made in connection with chloroform? We must not forget the importance of using only chloroform made by a reliable firm, since undoubtedly impurities may be contributing factors to bad after effects and possibly fatalities, and to keeping it under conditions which will prevent its decomposing.

Special Conditions Justifying the Use of Chloroform.

Some of the conditions under which the use of chloroform is fully justified are:—

1. *In Military Surgery as specified above.*
2. *In the Tropics.*
3. *In Obstetrical Cases to dull the Suffering during the Pains.*

At first sight it would appear that according to Levy's theory, there are in obstetrical cases the special factors which produce ventricular fibrillation —periods of light anesthesia with strong painful stimuli, but experience has proved that the danger in labor is very slight. So far no satisfactory explanation of this safety has been advanced.

4. *In Cleft Palate Cases in Infants and Very Young Children.* At the best these are very difficult cases for the surgeon and the results are often unsatisfactory. The absence of the excessive salivary secretion due to ether and the lessened vascularity increase the chances of the operation being successful and compensate for a slightly increased risk.

In young children it is usually recommended to commence ether with chloroform. This practice is by no means without danger. One occasionally sees, even after the change to ether has been made, a very marked pallor with feebleness of pulse and respiration. When chloroform is used in this way the change to ether should be made at a very early stage.

5. *Affections of the Respiratory System.*

(a) *Pulmonary Tuberculosis.* Nitrous oxid and oxygen are generally recommended for these cases.

In these days of extensive operations on consumptives for abdominal tuberculosis, there is often difficulty in getting sufficient relaxation. This can often only be obtained by adding chloroform or by using it alone. Moreover, nitrous oxid oxygen in some gas machines is breathed under more or less strong positive pressure from distended rubber bags. It is by no means certain that this distention of the alveoli by pressure may not affect the diseased lung unfavorably. These patients usually stand a prolonged chloroform anesthesia very well.

(b) *Emphysema and Asthma.* Patients with these conditions, if they are at all marked, undoubtedly do best with chloroform.

(c) *Coryza.* A patient with a cold should not be given ether. In cases of pneumonia following operation within a few days, it is astonishing how often one finds that the patient had a cold at the time of the operation. If the operation cannot be deferred, gas or chloroform should be used.

(d) *Empyema.* When the collection of pus is large and there is bronchitis, these cases should be done under local anesthesia, but if a general anesthetic becomes necessary chloroform seems often to be more satisfactory than nitrous oxid and oxygen, as there is less strain thrown on the lung. Where the collection of pus is small and the bronchitis slight or absent, ether or nitrous oxid may be given.

(e) *Obstruction to Respiration,* either by pressure from without, as in Ludovic's angina, or by growths inside, as in papilloma of the vocal cords, chloroform is especially useful. In the latter condition in young children the space for the passage of air is extraordinarily small, and only by the most careful use of chloroform can a satisfactory anesthesia be obtained. It is in such cases as these that the use of oxygen with chloroform is of undoubted value.

7. In strong muscular men for the *reduction of a dislocation or the setting of a fracture,* quick relaxation can be obtained by means of chloroform with very little disturbance or discomfort to the patient.

8. It was formerly held that chloroform was the best anesthetic for brain cases associated with increased intracranial tension. Experience has shown, however, that ether is much safer.

In conclusion, we must remember that though chloroform, like the surgeon's knife, is a dangerous weapon in the hands of the unskilful, we are entitled to use it only so long as we bring to the use of it a full sense of the responsibility we are assuming and the utmost degree of skill which we possess.

GROSVENOR APTS., SHERBROOKE ST.

EXPERIENCES OF AN ANESTHETIST AT THE FRONT.*

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As the title of my paper suggests, it is not to be a technical discussion but more of a random recital of some of my observations and experiences while on duty at various hospitals in the war zone in France. It was my good fortune to serve with hospital units both behind the English and American lines and also with the Australians. Thus I had exceptional opportunities for observing and contrasting the methods of the different organizations. But since comparisons are odious, I refrain from going into detail with reference to my impressions along these lines. I will, however, allow myself to say that we Americans did not possess all the good things and that from the standpoint of thoroughness and efficiency we had much to learn from our Allies, in the field of hospitalization.

THE PROBLEMS OF A MILITARY HOSPITAL.

The problems of a military hospital are not quite the same as those of a well organized civilian institution of a similar character. The difference is more manifest the nearer the scene of actual hostilities the former is situated. In a large general or base hospital conditions more nearly approximate those of the hospitals with which we are familiar at home. As far as possible the equipment is more or less ample; there is a sufficient personnel with which to "Carry On," and the group of workers composing the staff is well organized; while the close proximity to the base of supplies usually assures one an abundance of things to work with. However, a Casualty Clearing Station or an Evacuation Hospital is greatly hampered by a certain lack of these things. This is even truer still of a Mobile Hospital or a Field Hospital. There thorough organization and discipline and a proper "esprit de corps" go a long way in atoning for the lack of some of the things referred to. The Commanding Officer, Chief Nurse, or Matron, and the Quartermaster of such a hospital hold positions of great responsibility. My experience has been that, as a rule, those chosen for these executive positions were selected with great care. It is fortunate that they were, for the welfare of the wounded soldier lies very largely in their hands, strange as it may seem. Their responsibility in reference to the successful conduct of the Hospital in its practical workings may be compared to

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that of the General and his Staff who plan a campaign against the enemy. In both cases executive ability of a high order, vision, foresight, and an abundance of common sense and good judgment are essential.

If those in charge of the hospital are not big enough for the job when a time of crisis arrives, no matter how willing and efficient the operating surgeons, nurses, and orderlies may be, they will not be able to minister as they should to those they must serve. I know that this sounds trite, nevertheless it is true.

THE C. O., MATRON, QUARTERMASTER AND PADRE.

The C. O. can and must shift much of the responsibility onto the shoulders of his staff. Still he is the one who is held responsible and to him everyone looks for direction and inspiration. I shall never forget those busy, trying days during August and September, 1917, at No. 10 British C.C.S. in Flanders where the wounded from the battlefields beyond Ypres were being brought back in such numbers that we, with our limited staff, were literally swamped. There was scarcely any opportunity for sleep for days at a time. Through it all the Colonel in command was always on the job. At any hour of the night or day you would find him and his Sergeant-Major, who always accompanied him, in the wards, in the receiving tent, in the operating room, everywhere in fact, it seemed to us. Not a thing escaped his watchful eye. He had a word of encouragement for everyone, so that, in spite of the long hours, the fatigue and the nervous strain of our work, to say nothing of the depression caused by the sight of so many thousands of mangled bodies, he kept us "up on our toes" turning out the work and all in a fine spirit of harmony until the attack was over, and we could get an opportunity for a brief rest.

The same was true of the Matron and her supervisors. The wounded and gassed men were well and tenderly cared for, and as quickly as possible after operation, evacuated by ambulance train back to the Base Hospitals. She knew just how to get the best cooperation among her staff of nurses and she set them all a fine example of tireless energy. The Matron of a British Military Hospital holds a position of more than ordinary importance, and as a rule she is not the last one to be aware of the fact. Even so, these splendid, capable women are generous and large hearted and altogether human. Many a wounded lad lives today to thank them for their kindness and thoughtfulness. Their opportunities were many for supplementing the care of the overworked ward nurses and I assure you they made good use of these opportunities.

Not by any means of least importance was the Quartermaster. It was to him we looked for our supply of dressings, splints, medicines, and even our daily bread. His was no easy task, as you may well know, with our nearest base of supplies many kilometers away and transportation facilities very much overtaxed. To his credit, let me say that during all those feverish weeks we lacked no good thing. And I must not forget the Padres. It was their privilege to go from bed to bed in the long wards, cheering up the living, taking the last messages and closing the eyes of those who were not able to survive. writing the home letters and each morning leading the lonely cortege of flag-draped bodies which wended its way to the ever-enlarging God's Acre, where was laid to rest all that was mortal of those who had "given their last full measure of devotion" to save the world from the scourge of German "Kultur."

I have tried to sketch hurriedly a picture of some of the activities of a Hospital in the advanced zone and to give you some idea of its organization. I will not inflict on your minds any of the harrowing details which were constantly transpiring before our eyes or of the atmosphere in which we lived for days at a time. Even if I made the attempt you could not understand. I only wish that you might have *seen* a little of it. Just enough to give you some conception of the results of the fiendish and jealous hatred of the Hun who, for no other reason whatever than a selfish, bigoted, insatiate greed sought to destroy and cripple and ruin France and Belgium that he might prosper at their expense. History will ever record his crushing defeat and bitter disappointment and let us be thankful that we, as a nation, had a part in bringing this about.

THE ADVANCED HOSPITALS.

Let us look now for a moment at one of these advanced hospitals from a physical standpoint. Whether British, French or American they were very much alike. Usually situated on or near a line of railroad for convenience of transportation of patients and supplies they were either under canvass or in huts. More often they were a combination of both. The huts had wooden floors, while the tents used as wards perhaps had tarpaulins under foot or more commonly only the bare earth. When of the latter, at first it was of grass and turf but in a country like France or Flanders where rainy weather is more than common, it soon became a mass of trampled mud. The various huts and tents were connected by wooden duckboards and

walks. The outer edges of these walks were whitewashed to guide the stretcherbearers at night so that they would not fall off while carrying their wounded comrades. This precaution was necessary as no lights were permitted out of doors and all windows were kept darkened through fear of the Boche airmen. An additional precaution were the large red crosses painted on the roofs of the huts in order to indicate to the Hun, during the day, that that particular group of buildings was a hospital.

For beds, we used wire spring cots, stretchers, or rude wooden bunks, as conditions permitted. There was usually a generous supply of blankets. Sheets and pillow cases were luxuries, but as a rule obtainable. How the boys did appreciate being tucked in between clean sheets after weeks in the mud and filth of the trenches! The laundry problem was a serious one. The oiled linen had to be sent miles to the rear. When our Army adopted from the French the Mobile Hospital Unit, this item was greatly simplified. Each Unit carried with it on two large, specially built camions, a portable laundry outfit, the motive power being supplied by the engine of the camion or motor truck. There was an *x*-ray outfit similarly equipped, also a splendid sterilizing apparatus. In fact, an entire hospital on wheels, wonderfully compact and complete.

IMPORTANCE OF X-RAY AND FLUOROSCOPE EQUIPMENT.

The *x*-ray equipment was a most valuable adjunct to the military hospitals "over there." We could have scarcely carried on without it. Prior to operation, radiographs were made of practically all wounds in order to determine the location of bullets and shrapnel and to give the surgeon the proper knowledge of the extent and seriousness of fractures. And let me say in passing, it is remarkable what destruction of osseous tissue a very small fragment of metal can produce. It is almost unbelievable.

We perhaps never appreciated the true value of the *x*-ray in war surgery as we did at one of those front line hospitals where we were stationed which lacked this important item of equipment. The surgeons, of necessity, had to work, as it were, in the dark and many wounds could not be properly cared for because of the fact that we had no *x*-ray outfit. As a consequence, much more extensive excision of tissue was necessary. Even with good radiographs it frequently is next to impossible to find some of the smaller fragments. It was here that the fluoroscope proved invaluable.

The patient, anesthetised, would be taken into the dark room, placed upon the table and by the aid of the screen, the foreign body could readily be seen. If it were a chest case, oftimes the piece of metal could be seen imbedded in the respiratory muscles, or in the moving lung tissue perilously near the heart which, "like the little old Ford, ran right along." Wherever it was, the surgeon, deftly introducing his forceps through an incision previously made and guided, not by his sense of touch but by sight, would approach, grasp and remove the foreign body, thereby saving much valuable time and useless cutting. The Roentengenologist thus rendered a signal service in the hospitals during the war.

THE UNTIRING DEVOTED NURSING STAFF.

To the untiring, devoted services of our nursing staff much of the ultimate success of our efforts was due. Hats off to our splendid American Women who went "over there" enduring uncomplainingly all the discomforts and hardships incident to life behind the fighting lines. Many of them braved bombs and shells and poison gas as courageously as any man. I know whereof I speak, for I have seen them calm, cool and collected going about their duties, forgetful of themselves while the atrocious inhuman Huns were shelling and bombing the hospital full of desperately wounded men. Not only men, but women, gave their lives freely over there for the cause of righteousness and humanity.

The saddest sight I witnessed, in all my experience in France and Flanders, was the laying away of the cold form of a brave nurse who had fallen at her post of duty, killed by a German shell. This occurred at an Australian Hospital located almost in sight of the ruins of the once splendid city of Ypres. It was only by a miracle that several other nurses escaped the same fate. Here was an exhibition of the finished work of the detestable, Kultured Hun. Day and night our nurses worked, month after month, caring for our sick and wounded boys—yes and for those of the enemy as well, as our hospitals frequently contained wounded prisoners. To their splendid skill and kindly sympathy is due the fact that so many of our boys came back from France. We all recognize the value of good nursing. It is ofttimes half the battle and a big half at that. Our nurses and our well-trained orderlies greatly supplemented the professional skill of our medical officers. Indeed, to the sorely wounded, homesick boy, far from those he loved, these noble women brought a touch of home. Their cheery smiles and their sympathetic kindness, as well as their skill as nurses, no doubt kept many a lad from giving up the fight and "going West." To them also, fell

many of the hard, menial and unpleasant tasks and they deserve all the praise that we can give them.

THE ANESTHETIST'S PART IN THE GREAT WAR.

But, do I hear someone asking, "where does the anesthetist come in?" "When his grandchildren ask him what he did in the great war what reply will he be able to make?" I have purposely mentioned first the other members of the hospital staff and attempted to show how valuable were their services in the great scheme for caring for the men who so fearlessly and courageously made of their bodies a living barrier to the progress of the brutal German hordes. They, one and all, in their respective fields, rendered indispensable service. Yet none of them, from a humanitarian viewpoint excelled those men and women who deftly and skilfully soothed into unconsciousness the wounded men prior to their undergoing the operations which were so necessary in the saving of life and in ultimately returning numbers of them to the fighting lines. Operations which it would have been well-nigh impossible to endure had the men not first been anesthetised.

Yes, the anesthetist played a most important role in our military hospitals and everywhere I found the finest spirit of cooperation between them and the surgeons. Theirs was not a spectacular task. However, it was a most valuable one, and ofttimes carried on amidst great danger. One whom I knew paid the supreme sacrifice while at his post of duty as an anesthetist. Another, a women, for her coolness and steadfastness in time of great personal danger was decorated by the British authorities.

In our American Army, the greater number of aneshetists were especially trained men and women. On the other hand, in the British service where I spent the larger part of my 23 months overseas, the anesthetizers were M. O.'s who were assigned to that particular duty. However, toward the close of the war we trained at our hospital several British nurses in the use of both gas-oxygen and ether. This was done at the request of the British war office in order that these trained anesthetists might relieve medical officers for duty with battalions at the front.

THE ANESTHETIC AGENTS USED.

This brings me to the question of what anesthetic agents were generally employed. *Ether,* of course, was given first place because of its convenience and comparative safety, combined with the fact that its use does not entail the employment of a cumbersome apparatus. The Scotch surgeons preferred ***chloroform*** and this was used almost exclusively in some hospitals with excellent results. As far as I could learn its use was not general in American hospitals. Ethyl chlorid and Somnoform were employed considerably in the British service, particularly for operations of a minor nature. One prominent anesthetist from Melbourne, Captain Hornabrook, used the latter almost exclusively in his clinic with very satisfactory results, as he told me. During the summer of 1917 while in Flanders at No. 10 British C. C. S. and at No. 3 Australian C. C. S. I employed chloroform to induce anesthesia and then substituted ether for the remainder of the narcosis.

The British objective that summer and autumn was the strategically important Paschaendale Ridge, beyond Ypres. The fighting was fierce and sanguinary. It lasted for weeks and our losses were apalling as were also those of the enemy. With the wounded streaming back day and night by the hundreds, time was an important factor. Every minute counted and I found this preliminary use of chloroform very advantageous. It was by far more pleasant to the sense of smell of the patient than ether and much less irritating if, in addition to having been wounded, the man "had had a touch of gas. "Often, in such slightly gassed cases, I employed chloroform throughout. We were dealing with young men of fine physique and the results were quite satisfactory. Back at the Base Hospital we invariably administered nitrous oxid and oxygen to such cases.

Ether-oxygen was another favorite method in the more or less serious cases. There was a fairly abundant supply of oxygen provided and by attaching a cylinder of it to a Shipway apparatus a very pleasing result was obtained. It seemed to stimulate the heart action and anesthesia was maintained with an excellent color and full deep respirations. Our supply of N_2O was quite restricted and the only apparatus at hand was an antiquated Hewitt which was operated by means of valves turned by one's foot. The tubing and attachments were imperfect but still by dint of much care and watchfulness, both of the apparatus and the patient, a fairly good anesthesia could be maintained. This I reserved for the most serious cases and I was thankful to have even such a makeshift on occasions. Without it, many of the men who were in a condition of severe shock through injury and great loss of blood would never have survived. For the chest and abdominal cases it was a life saver.

N_2O and O would have been the ideal anesthetic for all cases and a great conservator of the time but in a forward zone hospital the bulky apparatus and the difficulty of securing and transporting the heavy

cylinders made its use on a large scale almost out of the question.

However, one of our operating teams, when going to Flanders, did take with them a number of cylinders and an American made apparatus which they used to great advantage. The compactness of this outfit, the skill with which it was used and the excellent results obtained were a revelation to the British surgeons. As a consequence, I understood that an order was placed for several American outfits for use in their hospitals.

Our own Army, through the Red Cross, later brought to France and installed a complete plant for the manufacture of N_2O and oxygen. It was not in full running order until near the end of the war, however it supplied large quantities of N_2O and O to various army hospitals. Contracts had been let for the purchase of great numbers of apparatus and many had been delivered and were in use. Our wounded boys were ultimately to have been given all the advantages of this safest and best of all general anesthetics. By its use, no doubt, much post-operative pneumonia was prevented. This was particularly true when practically every patient coming to the hospitals from the mud and exposure of the trenches during the colder months was already suffering from bronchitis.

METHODS FOR CERTAIN SURGICAL PROCEDURES.

Where we had to deal with penetrating wounds of the chest we often found the use of chloroform very satisfactory. Ether alone by the drop method was contra-indicated but warmed ether vapor with oxygen gave good results. Some of these cases of a more serious nature were done under local anesthesia. This latter method or the employment of N_2O and O was our routine practice for chest cases at the Base Hospital.

Surgery of the thoracic cavity has made veritable leaps and bounds as a result of the experience gained during the war. Procedures heretofore deemed unwise and impossible have now become more or less common. Even the suturing of lung tissue and under some circumstances of the heart itself are now within the possibilities of modern surgery. Thus, some good has resulted from these years of human strife.

I have already referred to the Shipway apparatus for administering warmed ether vapor. We used this extensively in the British service. Besides being much pleasanter for the patient than ether by the drop method, it had the advantages of a quicker induction period with less struggling, much less mucous secretion and far less nausea. It also conserved at least 50 or 60 per cent. of ether, an item of no mean consideration when supplies were difficult to obtain.

It is a simple adaptation of the principle of the more complicated insufflation type of apparatus with which we are familiar here at home. It consists of an ordinary thermos bottle containing a U-shaped coil of metal tubing. Through this the vapor of ether or chloroform, or a combination of the two as desired, is forced from bottles of each attached to the apparatus and conducted by ordinary rubber tubing, to the inside of an Esmarch mask covered with gauze and a towel to confine the vapor. A valve or switch controls the mixture. Ordinarily a hand-bulb similar to the one used on a cautery is employed to drive the vapor through the bottles to the patient. I have used a foot-bellows for the purpose. We often attached a cylinder of oxygen when we desired to give ether-oxygen. By this method much less ether is dispersed into the atmosphere of the operating theatre than by the drop method, a fact much appreciated by those working for twelve or fourteen hours in such an atmosphere.

Usually there was no previous preparation of the patient prior to operation. Atropin was not necessary with the warmed ether method and in practically every case morphin had been given hypodermically at the dressing station a comparatively short time before the patient arrived at the the C. C. S. If so, this fact was always recorded, with the dose, on the patient's Field Medical Card. This, by the way, was a very ingenious though simple and exact, record of a patient's wounds and their subsequent treatment. It always accompanied him wherever he went, from the dressing station, through the various hospitals in France, crossing with him to the hospital in England which was his final destination. He could no more escape it than he could his shadow, and woe be to any attendant who permitted this card to be lost. It constituted a cumulative record of the patient's entire medical and surgical treatment.

As a rule, morphin was withheld from those suffering from severe shock as it apparently lowered their resistance in a marked degree. Marshall's opinion is that cases suffering from severe shock due to injury or hemorrhage have small chance of rallying if, before operation, they receive more than ¼ gr. of morphin. If exhibited at all it should be in small doses.

Chloroform as an anesthetic is contra-indicated in cases of shock. Under ether, they apparently improve during operation but often later there is a marked reaction and frequently a complete collapse. Nitrous oxid and oxygen is the anesthetic, par ex-

cellence, here. How often I regretted the fact that we did not have a proper supply at the casualty clearing station. Ether-oxygen was the best substitute at hand.

A light anesthesia is all that is required in such cases and with nitrous oxid and oxygen, if care is observed, there is no further fall in blood pressure and the patient rallies remarkably at times even after an amputation involving the upper third of the thigh.

An observation that was made by different anesthetists was that, if a patient had been anesthetized for a long period, say an hour or more, and then was turned over in order to facilitate the excision of other wounds than those given first attention, collapse was apt to occur. Because of this, care was usually observed in placing the patient on the table so as to avoid turning. The first half-hour appeared to make little difference. Accordingly, in a case of multiple wounds involving the turning of a patient, the minor ones received first attention, if this was allowable, and then the patient was placed in the final position for the operation requiring the most time.

THE PSYCHIC ELEMENT DURING INDUCTION.

Another interesting observation which I made was of a psychic nature and has no bearing on anesthesia except in the induction period. Patients anesthetized a few hours after being wounded, especially if they received their wounds during the intense excitement of battle, are very prone to have a period of violent excitement while in the so-called second stage of anesthesia. Apparently they live over their fierce and trying experiences on the battlefield, shouting, struggling, calling to their comrades and hurling wild challenges to the foe as though in the very midst again of the confusion and turmoil of battle. The assistance of several strong orderlies was usually necessary to restrain these violent patients.

Several days later, back at the Base Hospital, this experience is not so common. The impressions made upon their subconscious minds apparently become less distinct. At Camp Sherman, in dealing with our own soldiers returned from overseas I have found an entire absence of such phenomena. In fact, it is rarely that we ever have any marked symptoms of excitement.

MARSHALL'S OBSERVATIONS ON SPINAL ANESTHESIA

I have spoken of the various anesthetic agents which I employed in my work overseas but have not mentioned spinal anesthesia or analgesia. I had no experience with this nor with ether given intravenously, or per rectum. All of these methods were employed by different anesthetists with varying success though they were not generally used.

Major Geoffrey Marshall, of the Royal Army Medical Corps, made some interesting experiments with spinal anesthesia which I shall relate briefly in closing. He says, "In choosing an anesthetic for the more seriously wounded, the one overwhelming factor is safety. We require a method which will not be harmful to the patient already suffering from shock of injury and one which will minimize the shock of operation. It has been urged that spinal anesthesia would meet these requirements." He further states that his experience at base hospitals bears out this supposition but at the C. C. S. when dealing with recently wounded men, his results had not been so happy. Especially was this true of patients who had lost considerable blood. In these exsanguinated cases he finds that spinal anesthesia is strongly contraindicated and that the subcutaneous or intravenous injection of normal saline apparently does not assist in making spinal anesthesia at this stage any safer. He had had no experience it seems with it following blood transfusion. He further states, "In deciding upon the use of spinal anesthesia, the safest guide is the relative content of haemoglobin in the blood. The appearance of the patient is of little assistance, the pulse-rate and the blood pressure do not help us at all. In practice, I find that 110 per cent. hemoglobin is an average. If I find that a recently wounded patient has a percentage of hemoglobin present of over 100 per cent. it is usually safe in my opinion to employ spinal anesthesia. On the contrary, if it is below 100 per cent. he will almost certainly show a serious fall in blood pressure and collapse."

He cites 22 cases whose blood was markedly dilute which were operated upon soon after receiving their wounds. All but three of these showed signs of serious collapse.

Of 16 short interval cases which had not suffered from severe hemorrhage and whose blood was consequently not dilute 13 showed no untoward symptoms after injection. Six other cases which were operated more than forty hours after being wounded showed no signs of collapse. Continuing, he says, "If we then divide the cases into classes according to the length of time which elapsed between the reception of the wound and operation, we find that until we deal with intervals exceeding 40 hours, cases with dilute blood suffer a large decrease in blood pressure, as a result of injection of stovain, while the fall in pressure in cases with normal blood concentration is less than half as great. When the

interval exceeds forty hours the fall in pressure in both types is small and about the same."

He finds that though these different cases react differently to spinal anesthesia, there is however, little difference in the average initial pulse rate and blood pressure of the two types. As regards the appearance of the patients, some of those in the first group were obviously pale and some were not, although estimation of their hemoglobin showed their blood to be dilute. These latter ones showed as profound collapse as those in whom the loss of blood was evident clinically. Major Marshall in his experiments used stovain in 3 to 5 per cent. solution and in doses of one to two C.C. When smaller doses were used, he says anesthesia was incomplete or so slow in appearing that it was impractical for use at a C.C.S. Where he tried to combine spinal with general anesthesia the fall in blood pressure was more profound than in similar cases where either method was employed alone. In so far as I could learn he had not used novocain in spinal anesthesia. Some of the greatest falls in blood pressure, he says, were associated with the smallest doses of stovain and the reverse was also true.

In line with Major Marshall's observations are those of Lt. Com. Wm. S. Bainbridge. He states that, "in summing up the findings of many surgeons it would seem that spinal anesthesia is contra-indicated in persons already in shock or collapse and for this season it is considered by some to be unsuitable in war surgery." However, it no doubt has its place in war surgery though the cases which it is to be used should be selected cases.

CHLOROFORM FOR MINOR SURGERY.

While dealing with the employment of chloroform, I neglected to mention our use of it in minor surgical procedures in the case of those we termed the "walking wounded." A separate dressing tent was reserved for them and one end of it was kept clean and sterile for doing primary and small secondary sutures. The patient would be placed upon the table and the operative field would be prepared and when everything was in readiness, a cone in which had been placed five cc. of chloroform would be handed to the patient with proper instructions and suggestions. After a few inhalations, sufficient anesthesia would be obtained to permit excising and cleaning up the wound and inserting the sutures. This method proved very satisfactory. It pleased the patient, dispensed with the services of a set of stretcher bearers, answered the purpose of the surgeon and was a great time saver.

SOME OF THE RESULTS OF SERVICE.

There were times, too, when we were extremely busy, when every minute counted. Again there were others when we could work without such breathless haste. During the summer and autumn of 1917, and again when the great German drive was threatening us in March, April, and May, 1918, as well as during the fierce and feverish fighting of the closing weeks of the war, we worked under tremendous pressure, sixteen to eighteen hours at a stretch, for days at a time. Our record for one period of ten days was one hundred major operations a day. Were we tired and exhausted? Well, just ask us! Yet, throughout all our experiences there was the finest spirit of cooperation on the part of all and when our work was finally finished we felt a just pride in what we had accomplished.

Base Hospital No. 4 cared for over 70,000 patients, 4,500 of whom were Yanks, while our Mobile Hospital, during the short period of its existance, has a record of another thousand.

Our relations with our British and French confreres were very congenial. We had much to learn from each other, and I am sure that we, as representatives of different nations, grew to admire and understand each other in a manner we little dreamed of before our common experiences in the war. It was a period of our lives which we shall never forget. The sublime fortitude and courage of the wounded men made us ashamed to even think of our own little troubles and taught us not to complain. Our community life taught us patience, forbearance and cooperation; while our contact with other races and peoples broadened our horizons and quickened our sympathies.

We learned how true it is that one-half of the world does not know how the other half lives, and that this ignorance is largely the source of so much of the misunderstanding between nations. If the war has accomplished nothing else, it has brought the ends of the earth into closer proximity than ever before and made us in reality neighbors, and let us hope in time—brothers. While no doubt it has made each one appreciate more highly his own land and customs, we have discovered much that is good in other lands and peoples which we never suspected. We shall never be as insular as before. Is it too much to hope that as a result there will in the future be developed a still closer bond of fellowship between those who fought and worked and played together "over there," during those trying days? We have learned many things of value to us, professionally and otherwise.

For some of us the hardest lesson is still to be learned. That is, how, after two years of army routine to adapt and readjust ourselves to the demands of civilian life. Personally I find that it is not easy. Eventually it will be accomplished and we shall emerge out of our various experiences in the Great War bigger, broader, and more useful men and women. We have learned something of the joy of unselfish service, and that alone should be worth any sacrifices it has cost.

3794 W. 25TH ST.

ETHER ANALGESIA BY INHALATION FOR MINOR OPERATIONS.*

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The method herein described is a modification of the ether *rausch* used frequently, especially in the German clinics, by which an analgesia lasting from 1 to 3 minutes is produced by having a patient take several breaths from a closed cone saturated with ether. An attempt has been made to improve upon this rausch by lengthening the induction period, thus making it safer and more pleasant for the patient, and by prolonging and controlling the period of analgesia so as to widen the field of operations to which it is applicable. The method was developed in U. S. Base Hospital 13 in France as a result of the very frequent need of producing analgesia or very light anesthesia, nitrous oxid gas being unobtainable in our hospital center. Local anesthesia was not only unsuitable but contraindicated, many wounds being severely infected.

VARIOUS METHODS OF ANALGESIA.

That there is need of analgesia in the surgery of civil life, but more especially in the surgery of wounded soldiers is apparent from the large number of mixtures of drugs and methods of administration reported in recent literature. There is Capt. James T. Gwathmey's oral method. He administers 1 fl. ounce of 50 per cent. ether in liquid petrolatum with 5 minims of peppermint water. This is given by mouth sandwiched between mouthfuls of port wine. One advantage of this method is that the presence of the anesthetist is not required. Capt. Arthur E. Guedel reports the use of a mixture of ether 24 cc, ethyl chlorid 5.5 cc, chloroform 0.5cc, and oil of orange 0.125cc. This mixture is given by inhalation by the closed method. A number of other mixtures including Somnoform have been employed. Wilkie (D. P. D.) reports success in obtaining a transient analgesia by applying 3 drachms of ether to a Schimmelbusch mask which is then wrapped and covered tightly with a towel.

Analgesia begins in from 30 to 50 seconds and lasts from 50 seconds to 3 minutes. Our surgeons called for some method safer than ether by mouth or any ethyl chlorid mixtures by inhalation and for an analgesia often lasting more than 3 minutes, hence the following was worked out and employed in over fifty cases.

*Read during the Seventh Annual Meeting of the American Association of Anesthetists, at The Breakers, Atlantic City, N. J., June 9-10, 1919.

PREPARATION AND PRELIMINARY MEDICATION.

Thorough preparation of the patient, both physical and psychologic, is more important to the success of the analgesia than to the safety of the patient. Mild catharsis and restriction of food and liquids should be the same as before any general anesthetic. A hypodermic injection of morphin and atropin given about 1 hour before the operation aids materially in calming the patient's mind and is helpful in producing narcosis though not at all essential. The cooperation of the patient is quite necessary. His confidence can practically always be gained by telling him that he will not have to take much ether if he will relax his mind as well as his muscles, that he will not be sick afterwards and can eat and drink as usual. He is assured that he will feel no pain, that his operation is not serious nor exceedingly painful but a little too painful to be performed without an anesthetic. He is promised that he will not feel any sense of suffocation as he is going under, and he never should, or his fear is excited.

TECHNIC AND APPARATUS.

The technic and apparatus are simple and easily adaptable to use in the wards as well as in the operating room. A Schimmelbusch mask covered with two layers of fine wool stockinette is preferable. A towel or gauze roll is in readiness for wrapping around the edges only, of the mask. The patient's eyes are covered with wet cotton. Squibb's ether is preferable, though several of our cases were given the British P. P. of ether and Merck's ether. It requires a little more of the British ether than of Squibb's. Mallinckrodt's ether was a failure in these cases.

The patient is in the operating room or in bed in his ward so that he is not moved until after the operation. If he is strong he is firmly yet comfortably tied down. Patients operated upon in bed were never tied. The field of operation is prepared and the surgical team is ready to begin work. Then the administration of ether is begun. The mask is lowered to the face by the end of 2 minutes if possible, and after a few more respirations the towel is wrapped around the mask, tightly if the patient is large and husky, but loosely if he is not. At the end of 4 to 7 minutes the patient is almost always ready for the operation. During this induction period there should be very little talking or other noise in the operating room and the surgeon and assistants should not palpate, probe or touch the patient anywhere near the field of operation. This non-interference in the first few minutes cannot be emphasized too greatly, for a patient feeling a probe

will fear that he is being operated upon and he may be past the stage of reasoning. He is taken just *to* but not *into* the stage of ether excitement. He is usually in a state either of semi-consciousness or of unconsciousness, though occasionally he may be conscious. It is very difficult to maintain this state and to increase the administration at exactly the proper rate when painful procedures are begun, since the margin between perception of pain and the excitement period is exceedingly narrow. It is, I believe, a considerably narrower margin than that between consciousness and the asphyxial stage with nitrous oxid-oxygen.

After the anesthetic is once begun very little is said to the patient except an occasional word of instruction to breathe regularly and naturally, or a little faster or more deeply as is needed in the individual case, and an occasional assurance that everything is all right and that he is doing splendidly. When he is ready for operation a quiet signal is given to the surgeon to begin. In some subjects it is difficult to maintain the desired stage of analgesia or light anesthesia longer than from 3 to 5 minutes, while often it can be maintained quite satisfactorily for 10 to 20 minutes.

RESULTS.

The administration of ether can seldom be discontinued more than a few seconds before the termination of the operation. Within 1 minute after the mask is removed the patient will obey a command to open his eyes. Before the dressing is bandaged on he begins to grin and talk. His face is washed with cold water and he is told to take several deep inspirations through a cold wet towel. If this is done as soon as he is awake enough to respond, nausea will very seldom occur. Upon awakening the patient is very happy, often hilarious, but in 2 or 3 minutes he talks rationally. A few patients moved, talked or yelled during the operation, but showed no signs of shock afterwards, their color and pulse being those usually resulting from the stimulation which a small amount of ether produces.

Theoretically such a stage of extremely light operative anesthesia seemed impossible, but practically it was found to be possible in about 95 per cent. of the cases attempted. Two corps men, (medical students), who attained considerable skill in anesthesia, learned to give these light anesthesias quite successfully.

INDICATIONS AND CONTRAINDICATIONS.

The guiding factors in choice of subjects were, brevity of operation and the number of recently preceding and of probable future ether anesthetics to which the patient had been or would likely be subjected. Soldiers who have lived out of doors and drilled are muscular and require considerably more ether both to induce and to maintain general anesthesia than do people leading an indoor life who constitute the vast majority of patients in our city hospitals. But, on the other hand, most soldiers are good subjects for this primary anesthesia because of their ready cooperation and self-control. The only contra-indication observed is in the case of a partially united fracture which might be broken over if the patient should resist at a time when it was necessary to raise the extremity in order to properly insert through and through drains. If the patient should have sufficient perception of pain at any time to cause him to hold his breath, a few drops of ether should be poured upon his chest before time has elapsed for more than one or two respirations. The cold on the chest never fails to stimulate respiration if it is employed quickly enough. It can be repeated until sufficient ether has been inhaled to overcome the difficulty.

SUMMARY.

Since statistics and tables are prosy, only a collective summary of facts deduced from a carefully worked out table will be presented here.

1. A hypodermic injection of morphin sulphate gr. ¼ and atropin gr. 1/150 was given ½ hour to 2 hours preceding operation in about 14 per cent. of the cases reported.

2. Period of induction, 50 per cent. of cases required 4 to 7 minutes, 25 per cent. less than 4 minutes and 25 per cent. more than 7 minutes.

3. The usual amount of ether required was 1 to 1½ ounces. Fifty per cent. of the cases had 1 ounce or less, 10 per cent. having been given only ½ ounce; 20 per cent. were given 2 or 2½ ounces.

4. The chief merit of this method lies in the small amount of ether required. This is of paramount value in septic patients or those who have lost considerable blood or who are weak from prolonged and painful illness in bed. Most of these patients require only ½ to 1 ounce of ether over a period of 15 minutes or more. This amount cannot possibly endanger the kidneys or reduce to any dangerous extent the resisting powers of the blood.

5. The actual duration of the operation varied. It was less than 5 minutes in nearly 40 per cent. of the cases; 5 to 20 minutes in over 60 per cent. of the cases and was 10 minutes or longer in 25 per cent. of the cases.

6. The operations performed under this light anesthesia were quite varied. Many were the opening and drainage of abscesses, infected knee, elbow and smaller joints, opening of a deep abscess of

buttock from which a pint of pus drained; opening of abscesses in abdominal wall following injection of anti-tetanic serum; drainage of sinuses from compound comminuted fractures of various bones including the femur, and drainage of a subpectoral abscess following an infection of the index finger. In one case the soft parts of the stump of a thigh infected with gas-bacillus were radically removed. Parts of the matrix of infected nails were removed. A through and through bullet wound of the scapula and clavicle was opened and drained. Foreign bodies were removed even when imbedded in bone. An artery, hemorrhaging a few days after a hemorrhoidectomy, was satisfactorily tied. And even an exploratory laparotomy was performed with 1½ ounces of ether and no hypodermic adjuvant, the operation lasting 19 minutes.

CONCLUSIONS.

1. Painful dressings and short operations, even though quite painful, can be satisfactorily performed by having the patient inhale, without a sense of suffocation, less than 2 ounces of ether (2½ ounces as a maximum) during an operation continuing from 5 to 20 minutes.

2. This anesthesia is not preferable to nitrous oxid-oxygen, but is a most excellent substitute when gas is not obtainable or too costly.

3. The method is most practical, simple and adaptable.

4. The method is exact. The anesthetist determines at each moment what is the least amount of ether required. The patient is always awake 2 or 3 minutes after the operation. Such precision of dosage is possible only with the inhalation method. The presence of the anesthetist is necessary not only to regulate dosage and to guard the safety of the patient, but also in case the surgeon finds it necessary to perform a more radical operation requiring a deeper anesthesia.

5. Efficiency and *safety* are the most important considerations in any anesthesia. This anesthesia is as efficient as that produced by nitrous oxid-oxygen alone. It proved to be safe, there having been no untoward effects either immediate or remote even in cases just recovering from double pneumonia and severe attacks of influenza.

6. Hence this method of analgesia primarily resorted to in war emergency work, is recommended for surgery in civil life.

I am indebted to Major Vernon C. David, who was in charge of surgery in Base Hospital 13 during its active service, not only for the inspiration to perform these experiments, but for his most kind cooperation throughout the work.

1618 W. ADAMS ST.

HEART LESIONS IN ANESTHESIA*

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The conditions under which the anesthetist examines a patient are frequently far from ideal. The examination is often made with time limited and at short notice. Under such circumstances the exact diagnosis of the cardiac condition is not of first importance, but one must find out whether the heart lesion is compensated and determine how much of a strain can be put on the diseased organ.

THE BREATH-HOLDING TEST.

A general preliminary test that I have found of great use is the breath-holding test. This test is familiar to you all but I will repeat it. The patient is requested to take three long breaths, holding the last one as long as possible. If he cannot hold his breath for 40 seconds he is subject to investigation to show cause for this failure. The failure may be due to (a) respiratory embarrassment from disease of the lungs or pleura; (b) respiratory embarrassment from intra-abdominal pressure (tumor or ascites), (c) disease of the heart; (d) toxemia, (e) anemia, fatigue or excitement. *Lessened time* as you see does not necessarily indicate disease of the heart nor does full time always indicate a normal heart, but lessened time always shows cause for further investigation.

COMPARATIVE DANGERS OF VARIOUS HEART LESIONS.

Valvular heart leions that are perfectly compensated and with a reasonable margin of safety offer very little danger from the anesthesia. When, however, compensation is broken or the margin of safety is very narrow the danger of the anesthesia increases markedly. Lesions of the aortic valve are more serious than lesions of the mitral valve, and stenosis is more serious than simple regurgitation. Endocarditis and degeneration of the myocardium offer much more serious risks than chronic valvular disease, and I have a great fear of angina pectoris, and other conditions where the heart muscle is weakened. In general if the heart lesion does not interfere with the ordinary affairs of life it will not interfere with the taking of an anesthetic. One can get a fairly accurate idea of what the heart will stand under the anesthetic by the history of the behavior of that heart under the strain of ordinary life.

*Read during the Seventh Annual Meeting of the American Association of Anesthetists, at The Breakers, Atlantic City, N. J., June 9-10, 1919.

MAINTAINING BLOOD PRESSURE.

In the case of patients with serious disease of the heart of whatever nature it may be, there is one fundamental principle about which all our treatment should center—maintaining the blood-pressure at a point as near as possible to the level which is normal for that individual. One should keep this in mind in the pre-operative treatment, the operative procedure, the selection and administration of the anesthetic, and in the post-operative care.

PREOPERATIVE MANAGEMENT.

Wherever possible, patients with cardiac lesions should be put in bed, if they are not already in bed, and watched for a number of days without any change in their medication or food. The patient should be in about the position that he will have to occupy after the operation. This gives one an idea of how the patient should behave under conditions that would be ideal during convalescence—in other words, it gives us a *baseline.* Blood-pressure should be taken at least once a day and I wish particularly to emphasize the importance of the diastolic pressure. In this period one has an opportunity of observing the effect of the post-operative position on the condition of the heart and lungs.

The character of the diet before operation should be changed as little as possible from the normal. If the operation is to be at all protracted it is advisable to reduce the fats and increase the carbohydrates. I feel that the giving of 10 to 20 grains of sodium bicarbonate two hours before the operation is of some advantage. Cathartics should never be given unless the patient is in the habit of taking them.

When the time comes for the operation the patient should be *carried* to the anesthetizing room and never be allowed to walk or to exert himself in the least. Many of these heart cases are high-strung and nervous, and fright is certainly a factor that should be reduced to a minimum, even though it is not possible to eliminate it.

Morphin and atropin should usually be given as preliminary medication and it is necessary that they be given sufficiently early to allow of their maximum action before the anesthetic is started.

MANAGEMENT DURING OPERATION.

The patient should be placed on the operating table in a comfortable position. If the patient has been in the habit of sleeping with three or four pillows there is a reason for it. The patient has discovered the position in which he sleeps most comfortably and no preconceived ideas of ours should interfere with his comfort. There is a more potent reason for this than the simple giving way to the patient's whim. If one wishes to have a smooth induction it is necessary to have the patient physically as well as mentally comfortable. *If this usual sleeping position of the patient is not compatible with the operative procedure the position should be changed very gradually after the patient is fully anesthetized, for any sudden change may cause a serious interference with breathing or heart action.* It is particularly necessary to change the position gradually when the Trendelenburg posture is required, and the surgeon should be willing to dispense with this position in case of serious interference with the cardiac or pulmonary function, even if very inconvenient for him.

SELECTION OF THE ANESTHETIC.

With regard to the selection of the anesthetic. If the operation can be performed *without pain* under local anesthesia and the patient is not too apprehensive, this offers by far the least risk. It must be remembered that many operations that can be performed under local anesthesia without pain are not without certain sensations, namely, the feeling of pressure and traction, which may be interpreted as pain by a nervous and apprehensive patient. The fear in these instances may be a greater element of danger than the taking of a general anesthetic would be. Fear and pain will drive up the blood-pressure just as surely as ether or nitrous oxid, and the exhaustion following a long operation under local anesthesia is a factor that must be given proper consideration.

Spinal anesthesia should never be given to patients in whom the compensation is broken or in whom the margin of safety is narrow. It is a good rule not to use this form of anesthesia in any patient who will not stand a temporary fall in blood-pressure of 50 *per cent.* Patients with arteriosclerosis stand spinal anesthesia quite well and they usually have the sluggish nervous system well suited to operations on a conscious patient. Here again one should consider the nature of the operation, for it is generally conceded that spinal anesthesia is not safe for operations above the umbilicus.

Paravertebral anesthesia would offer many advantages over local or spinal anesthesia if it were not for the preliminary dose of scopolamin, a drug that is too much of a depressant and too uncertain

in its action to be used in cases with serious heart lesions.

Gas-oxygen, which has been heralded by its enthusiastic supporters as the safest of all general anesthetics, is in reality far from safe in many cases, especially in cases of broken compensation or angina pectoris. I believe that the danger is probably due to the rise in blood-pressure that is always present to a certain degree and may become quite extreme if rebreathing is excessive or where slight cyanosis is present. Operations requiring little or no muscular relaxation and of short duration may in many cases be done with less disturbance to the patient under gas-oxygen than under any other form of anesthesia, but where the operation is of long duration, and especially if muscular relaxation is required, this form of anesthesia offers certain grave dangers.

One of the advantages claimed by the enthusiastic supporters of gas-oxygen is the rapidity with which the patients regain consciousness after the operation is completed. This is certainly dramatic; but is it a real advantage? If the operation is one that will be followed by much pain the patient regains full consciousness at a time when this pain is at its height, and this may in part counterbalance the advantages of this form of anesthesia. The pain is much less if the anesthesia technic of Crile is followed out, but there is the loss of some time in doing the local anesthesia.

Another advantage claimed for gas-oxygen is the lack of nausea and vomiting—matters of considerable importance, especially in heart cases. I believe that almost as many patients vomit after prolonged gas-oxygen anesthesia as after open or vapor ether, but both the duration and severity of the vomiting are less. This is a real advantage.

Ether, like gas-oxygen, drives up the blood-pressure; but to a less extent, if properly given. Ether is a cardiac stimulant of more even action. Its use is usually followed by a period of deeper and longer depression than gas-oxygen, and it is this period of depression, following the administration of ether, that one should fear rather than the actual operative period. There are hardly any patients with heart lesions who will not go through the operative period of reasonable length with an ether anesthesia, but some of these patients will not survive this period of depression following. To a certain extent the length and severity of this period of depression are governed by the depth of the anesthesia and the length of the operation.

Chloroform, unlike gas-oxygen and ether, lowers the blood-pressure. Chloroform has certain advantages over ether. It is not unpleasant to take and it is somewhat quicker in its action. There are three periods of danger in its use. (1) Probably the highest percentage of fatalities in patients with heart lesions occurs during the induction, where with little or no warning the heart action stops. When this occurs it is not often possible to resuscitate. (2) The second period is during the maintenance, and the danger here is much less than in either the first or the third periods. (3) The third period is from three to five days after the operation and is due to the toxic action of the chloroform on certain organs, notably the liver, adrenals and heart muscles. Unfortunately, this action has not been recognized until quite recently, deaths occurring during this period being attributed to other factors than the anesthetic. I do not feel that we are yet in a position to estimate the seriousness of this danger period, though I believe that it is of real importance.

Anesthetic Mixtures.

Theoretically, it would seem as if we should be able to combine ether with chloroform in such a way that there would be little or no change in the blood-pressure. This has been tried for many years, notably by the English in the various A. C. E. mixtures. A mixture of ethyl chlorid, chloroform and ether has been commercially exploited and largely used in America, but I believe it is now falling into disuse, as are the A. C. E. mixtures of the English. The addition of a little chloroform to the mask is very useful when one induces anesthesia with ether, but the mixture should be made on the mask *as indicated* and not according to any preconceived formula. A very little chloroform dropped on the mask with the ether shortens the period of induction and reduces the amount of excitement. It also diminishes the rise in blood-pressure that is seen with a straight ether induction. It is rarely desirable to continue its use after the period of deep anesthesia has been reached.

Management During the Postoperative Period.

During the postoperative period it is more important in these heart cases than in the ordinary cases to prevent any unnecessary overload and to maintain the nourishment of the patient at a high level. Overload may come from various causes; among them the kidneys and intestines play a large

part and it is necessary to keep them functioning properly. Water must be given early and freely. When for any reason it cannot be given by mouth it must be given either by rectum or subpectorally, and in rare instances intravenously. It is advisable to begin food by mouth very early, and when I speak of food I do not mean beef tea and chicken broth; I mean food of real caloric value. When a patient cannot take food by mouth within 18 hours it is advisable to give nourishment by rectum. Glucose may be given by rectum in 5 to 15 per cent. strength and liquid peptanoid may be added to this if desired or wherever rectal feeding has to be given over a protracted period.

VALUE OF DIGITALIS.

In spite of the modern skepticism about the use of digitalis in patients with arteriosclerosis, I feel sure that it is of considerable value in tiding over the period of depression that often follows operations on old people. Of the other so-called heart stimulants, most are absolutely useless. The judicious use of morphin must not be forgotten. *More heart cases require rest after the operative period than require stimulation.* I wish to emphasize the importance of attention to the careful and detailed treatment of heart cases during the preoperative and postoperative periods as well as during the operation and anesthesia.

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DISCUSSION.

DR. W. G. HEPBOURN, Montreal, Canada: It is a very good plan in handling patients with known heart lesions, coming to operation under general anesthesia, to digitalize in advance. In this way when the postoperative crisis arrives some three or four days after operation, the hearts of these patients are in condition to meet the extra strain placed upon them. In some cases there is time enough to begin giving the digitalis if patients show symptoms of decline after operation, but the former method is the safer.

DR. JOS. E. LUMBARD, New York City, N. Y.: Stange's breath-holding test, while a most valuable one for determining the fitness of patients for operations under anesthesia, does not always indicate heart lesions. Limited breath holding ability may be associated with many other conditions than those immediately affecting the circulation It goes without saying that such conditions must be differentiated if the test is to be rendered of any value. Also patients must be taught how to accept and perform the test properly. Personally I regard patients as bad, fair or good risks as they are able to hold their breath for from 20 to 30 to 40 seconds. While bad risks should be given the benefit of operations under local anesthesia, at the same time if the element of fear enters into consideration, then the bad risk should be operated on under general anesthesia, as the psychic strain on the heart of the conscious patient may exceed the effect of an anesthetic carefully given.

DR. S. GRIFFITH DAVIS, Baltimore, Md.: Occasionally emergency cases present in which it is difficult to differentiate acute cardiac conditions from other profound and endangering pathology. I recall a patient, hurried into the hospital, after a collapse on the street, showing every evidence of acute cardiac dilatation due to passive congestion of the liver, but giving a history of gastric ulcer from the report of the family doctor. Pain and rigidity of the abdomen pointed to a probable rupture of the gastric ulcer. On consultation it was decided that operation was imperative. Morphin ¼ gr. was given and ether administered by the open method, very carefully. All went well until relaxation supervened, when the heart ceased beating and after some five respiratory efforts death occurred. The abdomen was opened at once and it was found that passive congestion of the liver and not ruptured gastric ulcer was responsible for the symptoms that had presented.

DR. F. L. RICHARDSON (closing): I prefer the use of the newer digitalis preparations to that of the older tincture, which is slower in action. With them it is quite possible to establish a cardiac reserve if digitalinization is begun after the patient's reaction to operation is indicated. I agree with Dr. Lumbard that the breath holding test must be properly made and its results cautiously interpreted. It should never be made with the patient in a condition of apprehension.

THE INFLUENCE OF AGE IN SURGICAL PROGNISIS.*

ALBERT H. MILLER, M. D.
PROVIDENCE, R. I.

It is a matter of common belief that old people are not favorable subjects for surgical operations. The degree of danger attending operations on the aged is undetermined and the limits of the danger period are unknown. These points may be learned by consideration of the mortality rate at different ages in a series of operations.

RECORDS.

For this purpose a series of 1,000 consecutive cases has been chosen. The record of each case covers; the preliminary examination, the period of the operation, and the recovery.

The preliminary examination includes the age and appearance of the patient, the condition of the heart and lungs, an examination of the urine, and a test of the blood pressure. As the examination is made from the anesthetic standpoint, the surgical condition is noted in a general way but is not particularly studied.

CLASSIFICATION OF CASES.

Following the examination each case is placed in one of three classes which is then noted upon the record chart. Class 1 includes the good operative risks, patients free from serious organic defects and whose surgical condition is not likely to prove fatal. Class 2 includes the fair risks, patients handicapped by organic lesions but whose surgical condition is not specially serious.

Class 3 includes the poor risks, patients whose surgical condition is so serious as to render the outcome doubtful.

All patients of the first class are expected to recover. Operations on patients of the second class

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are approached with less assurance and major operations are performed only when urgently required. In the cases of the third class, the operations are urgently necessary and a high degree of mortality is expected. In making this classification, the blood pressure is a factor of prime importance but is disregarded in this study as it has been elsewhere considered.

Record During and After the Operation.

During the period of the operation the condition of the patient and data of interest in the anesthesia and the operation are noted frequently on the record sheet. This chart is ruled to correspond with time by the clock. The beginning of anesthesia, commencement of the operation, important details of the anesthesia or the operation and the completion of the operation are noted at the moment when they occur. The pulse rate, respiration rate, condition of the pupil, color, and systolic, diastolic, and pulse pressure are noted at five to ten minute intervals. The dosage of the anesthetic is noted continuously.

The postoperative record includes the character of the recovery, the presence or absence of nausea and vomiting, the presence or absence of complications, and the final recovery or death of the patient.

For such records a loose leaf system is most convenient and efficient. The recent record sheets and a supply of blanks are carried in one binder in the anesthetist's bag. The record sheets are kept in this binder for two weeks following the operation. If recovery is uncomplicated at the end of this time, the record is transferred to a permanent post binder. If any complication appears the record is held in the temporary binder until the outcome can be learned.

The record sheets are dated and numbered consecutively and are collected in series of 1,000 consecutive numbers. Accounts are kept on ledger cards which are filed under the patient's name alphabetically. On each ledger card is noted the operation number thus providing an alphabetical cross index by name of all the cases.

Several summary sheets are filed with each series of 1,000 records. One sheet headed deaths, contains the case numbers of the fatalities with the cause of death in each case. There is a similar sheet provided for complications. There is a sheet for gas-oxygen cases, one for ether cases, and one for cases of especial interest.

Such a record system requires little time and is invaluable in the study of such a subject as surgical shock or the one in which we are now interested.

Tabulation of the Cases.

To find what relation exists between age and postoperative mortality, it is necessary to tabulate a series of operative cases with regard to these two factors. In the following tabulation of 1,000 consecutive operations; Class A includes patients under 50; Class B, those between 50 and 60, and Class D, all over 70 years of age. Class 1, the good risks, Class 2, those patients who are handicapped by demontrable organic lesions and Class 3, desperate cases in which recovery with or without operation is problematical.

Tabulation of 1000 Cases.

Class A Under 50 years.
Class B 50 to 60 years.
Class C 60 to 70 years.
Class D Over 70 years.
Class 1 Good Risks.
Class 2 Handicapped patients.
Class 3 Desperate cases.

Total Cases.

		Class A	Class B	Class C	Class D
Total	1000	729	137	79	55
Class 1	734	603	78	34	19
Class 2	179	94	38	26	21
Class 3	87	32	21	19	15

Deaths.

		Class A	Class B	Class C	Class D
Total	45	12	14	12	7
Class 1	2	0	1	1	0
Class 2	14	1	5	3	5
Class 3	29	11	8	8	2

Mortality Per Cent.

		Class A	Class B	Class C	Class D
Total	4.5	1.5	10.21	15.19	12.72
Class 1	.27	.0	1.28	2.94	.0
Class 2	7.82	1.06	13.15	11.53	23.81
Class 3	33.33	34.37	38.09	42.10	13.33

Results.

The mortality rate in the 271 cases over 50 years of age is eight times as great as in the 729 cases of less than 50 years. The mortality rate increases slowly from 50 onwards.

Of the two fatalities among the 734 cases of Class 1, one resulted from peritonitis which developed after the operation. The second was due to coronary embolism. Although no organic defect was discovered at the preliminary examination, this case was inoperable under Moots' rule. Probably too little consideration has been given to this rule in making the preoperative classification of cases. In the cases of this class, the mortality rate is practically without variation corresponding to age.

In the cases of Class 3, age has but little influence on the outcome.

Among the 179 cases of Class 2, the patients handicapped by demonstrable organic disease but with surgical conditions not specially serious, the mortality rate in the 85 cases over 50 is 14 times as great as in the 94 cases of less than 50 years.

NOTES.

The original series of records which form the basis of this study were not made with this particular work in mind. Such records make available a scientific answer rather than an unsupported opinion for many problems concerning surgical anesthesia.

The run of cases where a professional anesthetist is employed are more serious than the average.

The fatalities in this series of cases occurred from twenty-four hours to three weeks after the operation. No death took place during or immediately following the operation.

SUMMARY.

In a series of 1,000 consecutive cases from the notebook of an anesthetist, the mortality rate in the patients over 50 was eight times as great as in the patients of less than 50 years. In the cases free from organic disease and in the desperate surgical conditions, there was little variation in the rate of mortality to correspond to the age. In the cases where complicating organic disease was discovered at the preliminary examination, the mortality rate in patients over 50 was fourteen times as great as in the patients less than 50 years of age.

131 WATERMAN ST.

ETHER ADMINISTRATION IN THE UPRIGHT POSTURE.*

FRANK DYER SANGER, M. D.
BALTIMORE, MD.

For many years I have been operating upon my patients under ether in the sitting posture. This is so commonly done in Boston and other Northern cities that usage has established the method; in some other sections of the country, particularly in the South, there seems to be a good deal of skepticism regarding its safety. I therefore endeavored, in a paper entitled "Some Advantages of the Sitting Posture in Nose and Throat Operations Under Ether," which I read before the Eye, Ear, Nose and Throat Section of the Southern Medical Association at Memphis, November 12, 1917, to show that many examples in clinical medicine suggest that the sitting posture possesses certain distinct advantages.

When I was requested to present this subject at the seventh annual meeting of the American Association of Anesthetists, I was somewhat dismayed at the prospect; I am, however, deeply appreciative of the honor you have conferred upon me, and deem it a great privilege to have my paper discussed by the distinguished members of this Association.

I would not presume to present before this body of experts any technical question connected with the administration of ether; what I shall venture to do is to call your attention to certain well established clinical observations regarding the behavior of individuals suffering from respiratory embarrassment, and inquire whether, since unconsciousness is not causatively related to the respiration but is an associated phenomenon, these observations do not justify a posture which might be termed the posture of selection from a respiratory standpoint in all operations which would not be hampered by it; whether these clinical observations could not be made helpful in the management of the respiratory difficulties which may arise in the course of anesthesia, and particularly; whether, in dealing with the more serious respiratory complications, with apnea, for instance; it would not be wiser to be guided by what the individual would probably do were he awake. In substituting our consciousness for the consciousness of our patient, should we not do for him what he would do for himself were he conscious?

RESPIRATORY PHENOMENA UNDER ETHER NARCOSIS.

During the course of ether narcosis, the respiratory phenomena are those which give us the most concern; one sees not infrequently some manifestations of suffocation, cyanosis, dyspnea, occasionally apnea. The clinician sees the same phenomena, and is impressed by the fact that under practically all circumstances the individual, when respiration is embarrassed, irrespective of the cause of the embarrassment, instinctively and sometimes unconsciously, assumes such a position as will insure the greatest freedom of respiratory movement. I trust that I may be permitted to quote at length from the paper above referred to.

REACTION OF THE CONSCIOUS PATIENT TO RESPIRATORY EMBARRASSMENT.

"Unless pain is a dominant consideration, the patient suffering dyspnea from compression of the lung, due to processes involving the pleura, always assumes a position which will insure the freest possible movement of the unembarrassed lung. Instinctively the individual with consolidation in one lung lies upon the side affected, to afford greater freedom of movement to the unaffected side. A disassociation of movement is thus accomplished in pathological conditions which would be physiologically impossible.

"When dyspnea results from bilateral conditions in the lung, from disturbances in the respiratory tract down to the division of the trachea, from con-

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ditions affecting the musculature of respiration, or the innervation of these muscles, the patient seeks an upright position. The person whose breathing is temporarily obstructed as a result of a simple coryza, finds it more comfortable to sleep high; the individual at table who chokes, instinctively gets up; the child suffering from laryngeal obstruction insists upon being held, and with broncho-pneumonia finds relief in an upright position upon the mother's shoulder. Spasm of the respiratory muscles, like spasm of the larynx, brings the individual almost instantly into an upright position.

"Even more striking is the position assumed by patients suffering from circulatory disturbances in the lungs. One recognizes one's cases of broken compensation at a glance as one passes through the general ward by the upright position assumed by the patients in bed. Their ability to sleep at a lower angle from night to night bespeaks the restoration of the circulation in the lungs, as certainly as does the fading of the cyanosis. Few pictures are more impressed in their uniformity in all clinical medicine.

"One might go on citing instances to substantiate the general proposition that dyspnea, which is the first phase of aspyxia, and which may eventuate in apnea if carried to its logical conclusion, determines decubitus when caused by unilateral conditions, and, when due to bilateral causes, brings the individual into a vertical position to insure greater freedom of all the usual respiratory mechanism and to call into activity all the so-called accessory muscles of respiration, which seem to be used to greater advantage in the upright position.

"Participating in this emergency work are the following muscles—the scaleni, trapezius, lavator-anguli-scapulae, sterno-cleido-mastoid, the sterno-thyroid, sterno-hyoid, serrati and pectorals. The last five probably aid inspiration by temporarily reversing their fixed point.

"Another possible reason for assuming the upright position is to relieve the diaphragm of the embarrassment of pressure, particularly when the abdomen contains fluid. It is also possible that gravity influences materially the venous congestion of the brain and relieves the respiratory center. In the absence of a state of almost complete annulment of the circulation in the arteries, it does not seem to me that gravity could greatly influence arterial flow.

"While these phenomena may be subject to slight variations in individual cases, I think it is true that a conscious person suffering any degree of asphyxia from any cause never voluntarily assumes a position which would hamper his respiratory movements, and he, particularly, would not dream of lowering his head below the horizontal. The asthmatic gentleman finds great satisfaction in so small a matter as an unbuttoned waistcoat. The orthopneic sufferer, in his extremity fighting for air, although suffering the most extreme exhaustion, sits upright in a straight arm chair, firmly grasping the arms in his efforts to maintain a fixity of position, that will insure the greatest possible action of every available muscle of respiration."

The Anesthetist's Traditional Management of Respiratory Embarrassment.

These few examples are sufficient to show that conscious individuals react to respiratory embarrassment along definite lines; when, however, the individual is unconscious, and respiratory embarrassment supervenes, as may occur in the course of anesthesia, the anesthetist substituting his consciousness for that of the patient, is apt to move along traditional lines which have come to be accepted operating room procedure; the jaw is carried forward, the tongue is grasped with forceps and dragged out of the mouth, the head is lowered from the end of the table, sometimes the lower portion of the body is raised. The next usual step is some form of artificial respiration.

"Carrying the jaw forward is undoubtedly a good practice if at the same time the mouth is opened; but pushing the jaw forward, at the same time jamming the mouth shut, increases the difficulty or renders breathing impossible in persons who are not free nose breathers, or in those cases—which are frequent—in which the venous congestion has so overfilled the turbinal bodies that the nose is occluded in consequence. Dragging the tongue out of the mouth is also beneficial in its results, but does violence to that organ, causing in some instances great after-discomfort, and subjects the patient to the danger of infection through laceration.

It is gravity that causes the tongue to go back and obstruct breathing. The same gravity will cause it to go forward and open the glottis if the patient is put in a suitable position. It is doubtful whether dragging the tongue forward has any other influence upon spasm of the glottis than to increase it, although intermittent traction of the tongue is probably a stimulant to inspiration. Dropping the head from the end of the table and raising the lower half or two-thirds of the body, using in either case the shoulders for a fulcrum, places all the posterior accessory muscles of respiration at the greatest possible disadvantage, since they are bearing the weight of the body. The extreme extension of the head

stretches the anterior group to such an extent that their action is also impaired. The inversion of the patient brings the weight of the abdominal contents upon the diaphragm, rendering its contraction more difficult, and finally gravitation dams back into the brain upon the respiratory center the blood surcharged with carbon dioxid. (Ask the next cyanotic individual you meet to stand upon his head and see if any consideration you can name will induce him to do it.) Fortunately these errors are usually committed serially, were they all accomplished at the same moment of apnea the recuperative powers of the patient would less frequently prove equal to the situation."

ARTIFICIAL RESPIRATION.

The necessity for artificial respiration will less frequently arise if everything is done to enable the patient to utilize his own powers. When we substitute artificial respiration for the natural function which we have helped to abrogate by hampering the respiratory mechanisms, the responsibility for the failure must rest upon us.

If artificial respiration becomes necessary it is of most vital importance that the entire respiratory mechanism be cleared for action, so to speak; our effort in performing artificial respiration is but the expression of the hope that the muscles will resume their action. We diminish that hope and frustrate our effort by placing the slightest obstacle in the way of natural respiratory movement, which clinical experience has abundantly shown to be best in the upright position.

One does not, in attempting to start a delicately adjusted mechanism, first throw that mechanism out of adjustment or place some obstruction in gears or bearings; similarly, in trying to re-start the respiratory mechanism, every muscle should be so unhampered that it will be able to respond to the faintest stimulus that may reach it. Recumbency does not meet these requirements. Its continued employment seems to me to be largely a matter of tradition.

It is probable that the recumbent position has been associated with the unconscious state from the earliest time. Sleeping recumbently no doubt gave rise to this association. It antidates all physiology. The fainting person must be placed in the horizontal position else he will fall.

THE THEORY OF ANEMIA OF THE BRAIN.

I am unable to say when the theory of anemia of the brain was first propounded, but it probably long antedates experimental physiology. It had become axiomatic in the profession when the use of anesthetics began. What could be more natural than that it should have become a guiding principle in anesthesia; that operating room tradition should be based upon it? Yet, what do we mean when we say anemia of the brain? Is there any clinical evidence to show that the difference between the amount of arterial blood in the respiratory center in the recumbent position and the upright position is sufficient to influence respiration? What is the laboratory evidence upon this question? Is the question not a qualitative rather than a quantitative one? A question of the blood content? The carbon dioxid content?

One is constantly confronted by the anemia of the brain theory when one discusses the untoward occurrences under ether anesthesia. So far as I have been able to discover there is no other reason for recumbency. No one seems to be willing to question their faith in the anemia of the brain theory, hoping no doubt, that they will not have an anesthetic casualty, and expecting their faith to sustain them in case the casualty occurs. On the other hand, the advantages of the upright posture in all cases of respiratory embarrassment are matters of such common experience that it seems strange that we have not availed ourselves of these advantages in other emergencies.

THE COMMON OBJECT OF ARTIFICIAL RESPIRATION.

The various methods of artificial respiration have for their common object the rhythmic expansion and contraction of the chest, resembling as nearly as possible the natural movements of respiration. The movement of the ribs is accomplished by the external application of force in the absence of muscular contraction. The method at present most in vogue is to place the body in the prone position in order to permit the tongue to fall forward, opening the glottis; at the same time to relieve the diaphragm of pressure. In this posture, however, the trunk is weighing upon, and hampering the movement of some of the most important respiratory muscles, it is a weight that must be lifted by each expansion of the chest. The force is then applied to the posterolateral aspects of the thorax; in other words, nearer to the articulated than to the free ends of the ribs; in the upright position with the head flexed the tongue gravitates forward and the glottis is open. Freedom from pressure upon the diaphragm is much more assured in the upright than in the prone position, the trunk not being added to the muscle load. In this position an operator and his assistant, without a great amount of exertion, can perform artificial respiration as long as there is reasonable hope of restoring the patient, being able to relieve each other without changing their positions, therefore without interfering with the rhythm of the respira-

tory movements; for while the assistant holds the head from behind (assuming that the patient is seated in a chair) maintaining the patient in the perpendicular, and, at the same time seeing that the head is flexed and if necessary the jaw forward, the operator seated in front of the patient is able to apply force to the antero-lateral aspects of the thorax nearer the free than the articulated ends of the ribs, which gives the same obvious advantage which would result from trying to manipulate a door or other hinged object from a point distal rather than proximal to the hinge. The operator, to relieve himself of the fatigue of such a procedure carried on for some time, can easily maintain the position of the patient from the front, keeping the head flexed, while the assistant, relieved of that duty, by encircling the patient's thorax in the attitude of embrace, will be able to continue the rhythmic movements of the chest at as great a mechanical advantage as the operator in front; and here, too, the force is applied to the more movable portion of the thorax rather than to a point of relatively little movement, i. e. the postero-lateral aspect. When a chair is not available, as for instance in drowning cases, when artificial respiration must be performed on the ground, the operator and assistant can kneel or sit in comparative comfort; otherwise proceeding as described above.

During the performance of artificial respiration by this method the patient is at all times in the best possible position to respond to any efforts that may be made by the muscles to resume respiratory movements.

Role of the Heart.

It may be objected that I have not taken the heart into consideration in this discussion. I have not done so because it does not seem to me that the phenomena ordinarily observed in the course of ether administration are heart phenomena at all. Were I convinced that the phenomena were wholly due to failure of the heart I might adopt a different procedure. Or if, in the presence of both heart and respiratory manifestations, it seemed as though the respiratory phenomena were secondary to the heart failure, I doubt, even then, the advisability of adopting a procedure which no degree of hardihood would induce one to undertake were the patient conscious. Does any one think of forcing his conscious patient, gasping for breath on account of failing heart, to lie down? Would he ever under any circumstances invert his patient? Not only does the upright position seem safe to me, but experience has taught me that it is comfortable for the patient, the after discomforts, such as ether-back, ether-tongue, ether-jaw not being experienced.

Advantages of the Upright Posture.

The position offers numerous advantages from the operator's standpoint; the exposure is good, illumination is easy, hemorrhage, particularly venous oozing, is less troublesome than in the recumbent position; therefore less assistance is required, which is an important consideration when operating in so small a field as the nose and throat. Ether administration by any method in this position is easy; not infrequently the anesthetizer with whom I am accustomed to work, finds it convenient to hold the head during short operations, as for instance tonsillectomy and adenoidectomy, thus simplifying the procedure.

Never having had an ether death or a serious ether emergency in a period of twenty-two years, during which I have employed the upright position constantly, it is but natural that I feel like urging its more general use.

525 N. Charles St.

Discussion.

Dr. S. Griffith Davis, Baltimore, Md.: In anesthetizing for Dr. Sanger I have put to sleep patients of all ages, from infancy to senility, and they have represented every possible condition of comparative health and virulent disease. All sorts of heart lesions have been encountered, but only one cardiac patient caused us anxiety and that patient was operated in the recumbent position. Since then all cardiac patients, irrespective of their lesion, have been operated under general anesthesia in the upright posture. I have naturally been anxious about some of them although the position during operation was that which they assumed themselves in the wards and in bed. While we have had no occasion to use artificial respiration in the upright posture, I believe, with Dr. Sanger that the posture has advantages over the prone so far as resuscitation is concerned. I recall one patient, the wife of a doctor, who was persistently cyanotic under light etherization in the upright posture, but it afterward developed that she was susceptible to opiates and had had ¼ gr. of morphin, apparently enough to decidedly depress her respiration. Patients are anesthetized in the horizontal position, either with straight ether for children or gas-oxygen-ether sequence for adults, after which they are sat up in a straight-backed chair, and I take charge of the position of the head and assisting the operator while some one else carries on with the anesthesia. As Dr. Sanger uses periods of pressure during his tonsil operations, the closed cone method of etherization answers all requirements and the cone is simply reapplied, after the initial induction, during the time the operator is not working. Under continuous vapor anesthesia the operator gets a good deal of the anesthetic and this is another reason why Dr. Sanger prefers the closed cone for his cases. An open airway is maintained by keeping the tongue forward with a curved-blade retractor and the anesthesia is kept light enough not to abolish the laryngeal reflexes. As long as the coughing and swallowing reflexes are not abolished there is no danger of the patient inspirating blood or debris into the airway. Any swallowed blood is vomited when the patient is returned to bed, so swallowing a little of it does no harm. Anesthesia and operation in the upright posture is a good thing and should be more routinely used.

Dr. J. T. Gwathmey, New York City, N. Y.: I am rather surprised that Drs. Sanger and Davis have not availed themselves of the advantages of a French chair-table, which adapts itself so splendidly to operations under anesthesia in the upright posture. It is far superior

to placing the patient in a straight-backed chair and assists materially in helping to maintain the patient's posture. As anesthetists we should encourage the use of the upright posture as it facilitates the administration and effectiveness of anesthesia on account of the cerebral anemia induced. The sequestration experiments and methods of Dawbarn are of interest in this connection. He found that by sequestrating part of the blood volume in one or more of the extremities that anesthesia could be far more readily induced and maintained and that recovery was far more rapid after the sequestrated blood was sent back into the general circulation. I cannot conceive that the upright posture is either the theoretical or practical one for resuscitation, although it may be the most convenient. The cases of apparent chloroform deaths which have recovered almost invariably are those in which the patients were at once put into the extreme head-down position. Whatever is to be done in the way of resuscitation by artificial respiration must be accomplished in a very few moments, and I would hesitate to trust to the upright posture during this precious period. At St. Bartholomew's special clinic for throat operations we have about eliminated the second stage of anesthesia by passing nitrous oxid-oxygen into an open mask. There is no break in this technic as in the closed method. Anesthol is used during induction, if desired, then the nitrous oxid-oxygen is passed through the ether to the open mask, on which some essence of orange has been dropped. Ninety per cent. of patients thus put to sleep do not so much as raise their hands. They may even be allowed to hold the mask to their face during induction, the method is so pleasant. Once surgical anesthesia supervenes anesthesia is continued through nasal tubes, the mouth-gag or whatever device the anesthetist and operator prefer. With this method the anesthetic technic requires so little of the anesthetist's attention that he can assist the operator by maintaining the position of the patient's head, by swabbing out or aspirating the blood and by counter pressure at the angle of the jaw. The anesthesia can be regulated to conserve the reflexes and it is usually so light that recovery is almost immediate on leaving the table or return to bed and the amount of postoperative attention or nursing is reduced to a minimum.

DR. SANGER (closing): If the border line between the swallowing and coughing reflexes can be maintained the larynx will take care of itself and no inspiration of blood or debris will occur. Operator and anesthetist can keep tab on the perfection of their methods of operating and anesthesia by the incidence or absence of lung abcesses following their tonsil operations.

THE AMERICAN ASSOCIATION OF ANESTHETISTS WILL MEET IN NEW ORLEANS, APRIL 26-27, 1920, THE FIRST TWO DAYS OF A. M. A. WEEK. THIS—THE EIGHTH ANNUAL MEETING WILL BE THE FIRST ANESTHETIC RALLY EVER HELD IN THE SOUTH AND IT IS HOPED THAT SOUTHERN ANESTHETISTS WILL COOPERATE IN MAKING THIS MEETING A BIG SUCCESS. THERE ARE MANY SOUTHERN ANESTHETISTS WHO ARE NOT MEMBERS OF THE A. A. A. AND THESE SHOULD JOIN AT ONCE, AND HELP IN PROMOTING THE INTERESTS OF THEIR SPECIALTY.

UNDOUBTEDLY SOME OF THESE ANESTHETISTS HAVE BEEN MAKING INTERESTING AND VALUABLL RESEARCHES AND CLINICAL OBSERVATIONS. BY ALL MEANS THEY SHOULD PREPARE PAPERS ABOUT THEIR LATEST ACHIEVEMENTS AND REQUEST A PLACE ON THE PROGRAM FOR PRESENTING THEIR CONTRIBUTIONS.

IF YOU HAVE ANY SUGGESTIONS FOR MAKING THIS EIGHTH ANNUAL MEETING AN OUTSTANDING ONE, GET IN TOUCH WITH THE SECRETARY AT ONCE AND LET HIM HAVE THE BENEFIT OF YOUR IDEAS.

A SIMPLE METHOD OF ADMINISTERING ETHER WITH OXYGEN AND ITS ADVANTAGES.*

JOSEPH E. LUMBARD, M.D.
NEW YORK CITY, N. Y.

In presenting this simple method of administering ether with oxygen and emphasizing its advantages, I do not pretend to advocate anything strikingly new or revolutionarily scientific. It is simply a commonplace and safe method of anesthesia which is easily taught and readily applied. While it is a method familiar to many anesthetists, I have always been surprised by the fact that it is so infrequently taught to interns or those being initiated into the specialty of anesthesia.

Perhaps someone in the discussion will throw some light on this neglect to include this safe and simple method among those routinely used in hospital service.

Be that as it may, the tendency, at present, is toward the use of such methods of anesthesia as are not only simple and safe, but more especially advantageous to the operator, so far as his surgical demands are concerned, as well as to the recovery of the patient. If there is any adjunct to general anesthesia more valuable to the welfare of the patient than the use of oxygen, I would like to know of it.

Those who use nitrous oxide-oxygen anesthesia extensively are decidedly appreciative of the potent influence which the oxygen element in this method of anesthesia exercises.

If any criticism is tenable against the anesthetist, it is the failure to carry this appreciation of the value of oxygen into the routine administration of other anesthetics.

With comparatively inexpensive supplies of oxygen now becoming more and more available and practical, the tendency toward a routine use of oxygen with all anesthetics is growing rapidly to the benefit of all concerned. It is no longer considered good anesthetic practice to limit the use of oxygen to conditions of embarrassed respiration or circulation or as a terminal remedy. Oxygen should be considered in the role of a stimulant and a prophylatic.

VALUE OF OXYGENATION.

While a great deal has recently been written into the literature of anesthesia on the subject of carbon dioxid, in its relation to anesthesia, acidosis and shock, the vital role of oxygen in conserving the

* Read during the Seventh Annual Meeting of the American Association of Anesthetists, at The Breakers, Atlantic City, N. J., June 9-10, 1919.

proper oxygenation of the body during anesthesia has been more or less overlooked. With chloroform it is quite possible to reduce oxygenation to very imperiling degrees without establishing any external signs This holds good to a less extent with ethyl-chlorid, while with ether and nitrous oxid, more fortunately, cyanosis or asphyxia very promptly warn the anesthetist of any limitation of oxygen requirement. With ether and nitrous oxid, however, there is a deplorable tendency to permit long-continued, low-grade cyanosis without sufficient appreciation of the bad effects. Many cases of postoperative nausea, vomiting, acidosis and acetonuria are directly traceable to persistent, although scarcely noticeable cyanosis.

While Henderson emphasizes the conservation of carbon dioxid tension to preserve the rose-pink color safeguard, it is quite remarkable how equally important proper oxygenation is in maintaining this satisfactory index of the patient's systemic reaction. Gwathmey, in a series of studies, has shown that oxygen increases the safety of all anesthetics without decreasing their anesthetic effect.

Vapor anesthesia, using oxygen as a vehicle, provides about as attenuated an anesthetic vapor as is consistent with surgical degrees of narcosis, although it is not at all difficult with ether-oxygen anesthesia to meet any requirements of the operator for sufficient relaxation. While experimentally there may be some objection to the use of pure oxygen as a vehicle for anesthetic vapors on account of the pulmonary effects in animals, apparently this objection is without force in clinical experience. There is no noticeable reaction on the part of the human lung to oxygenation. In fact oxygen may be injected into the tissues without any inflammatory reaction; this has recently been done for quick stimulating effect in pulmonary crises. Oxygenation may be said to be innocuous so far as any untoward effects are concerned.

Indications for Oxygen.

I might emphasize the great importance of using oxygen in those cases in which it is especially indicated, but that would detract from my plea for its routine use in all cases. If it is necessary in certain desperate conditions of respiratory obstruction, cardiac decompensation, or marked depression from sepsis or shock, it is equally serviceable in the average anesthesia as a preventative of those disagreeable after-effects so common to cruder methods of anesthesia.

Cyanosis, regardless of its origin, is evidence that the respiratory function is greatly disturbed and is an S. O. S. call for oxygen. Similarly oxygen is indicated with anesthesia in all cases of shock, regardless of the cause, whether precipitated by trauma, hemorrhage, pain or sepsis.

Anesthesia is especially trying to the respiratory function in the extremes of life and oxygen is consequently especially gratifying in its effects when used in youth and old age. It not infrequently happens that operative procedures have to be abandoned on account of the excessive secretion of mucous in the young under crude methods of etherization.

It is quite surprising how oxygen as a vehicle for ether vapor prevents this complication and how useful it is in allaying the bronchial reactions of the aged under anesthesia.

There is no respiratory condition more disagreeable under anesthesia to patient and anesthetist than empyema. Under ordinary etherization the sensation of suffocation is extreme and the coughing excessive. With oxygen-ether vapor anesthesia, empyema operations are made safer for the patient and more satisfactory to both the surgeon and the anesthetist. It obviates the tendency of nitrous oxid-oxygen to exaggerate respiratory efforts. It is also a fact that only the most expert anesthetists are capable of handling empyema cases under nitrous oxid anesthesia and on this account the ether-oxygen technic is routinely preferable for the average anesthetist.

Another condition which ether-oxygen is especially indicated is eclampsia, although it is infrequently used for operations during this complication even in our best clinics. In view of the fact that etherization is almost universally used in the presence of eclampsia, it is all the more important to emphasize the value of ether-oxygen vapor anesthesia as against other methods of etherization. In fact, the oxygenation coupled with proper antiacidosis therapy will go far in tiding patients through the crisis of eclampsia.

Occasionally patients come to the operating room for tonsil and adenoid operations suffering for years from oxygen limitation, in fact their respiration is almost mechanically obstructed. In both types of patients it is equally important to provide for excess oxygenation.

It is also quite remarkable what a hemostatic effect oxygen has when associated with ether in tonsil and adenoid operations. Oxygenation will cause almost immediate clotting of the blood. This is very evident when using the suction apparatus.

Alcoholics are the bane of the anesthetist's existence. Their reactions to all sorts of anesthesia are anything but pleasant or convenient and I doubt if

they become extinct when the prohibition wave strikes us July 1st, 1919. Few can handle alcoholics under nitrous oxid-oxygen, while many are prone to die under straight chloroform. An ethyl chlorid induction followed by ether, chloroform-ether, or better yet ether-oxygen vapor is an approach to an ideal anesthesia for alcoholics, as the leeway of safety is considerable while the potency of the anesthetic effect is sufficient to control even the most obstinate. One of the effects of alcohol itself is to produce continued cyanosis of varying intensity and the attending oxygenation clears up this complication.

ETHER-OXYGEN ANESTHESIA AS A ROUTINE METHOD.

Personally I use ether-oxygen vapor anesthesia as the method of choice in most operations demanding a prolonged narcosis. It is my decided impression that patients keep a better color, pulse and respiration than under most other forms of anesthesia. What is especially important is that any degree of relaxation may be secured without jeopardy to the patient's welfare and with entire satisfaction to the surgeon.

Ether-oxygen vapor anesthesia is perhaps the most serviceable method of anesthesia for taking care of the usual heavy work in large general hospitals. While there may be exceptions to its use, it fits most conditions more advantageously than any other routine technic of anesthesia to the entire safety and satisfaction of all concerned.

EQUIPMENT.

Fortunately ether-oxygen vapor anesthesia may be given with a very simple equipment, although experts in anesthesia have developed many ingenious devices for perfecting the administration for all possible conditions and purposes. The simplest and most practical method of procedure is to use the wash bottle attached to low pressure oxygen tank for the ether container. A twelve-ounce bottle two-thirds full of ether, is what I usually use. Not only will this amount of ether suffice for most any operative procedure, but this quantity is necessary to provide a proper strength of vapor. It is also important to carry the tube from the oxygen tank almost to the bottom of the wash bottle so that the oxygen will at all times bubble through a large quantity of ether. The tube from the bottle to the mask should be short, inside the wash bottle, and the bottle so placed that there is no danger of liquid ether being pumped to the patient. Care must also be exercised in connecting up the tubing from the tank and to the mask so that this accident will not occur. Be sure that everything works properly before applying the mask to the patient. The tubes projecting into and leading from the wash-bottle or ether container should be made of metal or glass, and fitted through the stopper in an air-tight manner.

The low-pressure oxygen tank is a convenient source of oxygen supply as its contents will serve for a number of operations; it is present in almost all operating rooms and its value and pressure admit of easy and delicate manipulation of the oxygen flow. For facility of transportation, use at the bedside, in the home, the clinic or office, small tanks of compressed oxygen may be used. The principal item of expense with oxygen is the cost of transportation.

In the teaching clinic, especially, the tank supply of oxygen is preferable to motor blowers for compressed air as it is noiseless and does not interfere with instruction, a point of considerable importance. Also the supply is far more dependable than that of air by means of an electric blower which is prone to get out of order. It is also preferable to air provided by hand-bulb or foot-bellows, as it makes no demands on the anesthetist's energy, attention or time. The turning of a valve is his sole anxiety. All his other faculties are concentrated on the patient's condition.

This modified Yankauer mask, which I have devised, is a very suitable one through which the patient receives the ether-oxygen vapor. The wire-mesh dome is perforated by the tube carrying the vapor. This tube is expanded into a perforated disk inside the mask and over the patient's nose and mouth. The tube is on a swivel and can be turned in any direction so that the tubing from the ether container is never in the operator's way. The mask is covered with the same amount of gauze used for the open drop ether method, and over this is placed a small rubber dam with an air vent one inch in diameter. This dam helps retain the ether-oxygen vapor and the air vent makes a convenient spot for the preliminary use of drop ether, ethyl-chlorid or C-E mixture for induction or supplemental anesthesia. A wet towel or gauze will serve the same purpose if the rubber dam is not at hand. No effort is made to effect an air-tight adaption of the mask to the face by means of cotton or an inflated rubber rim.

It is my impression that too close an adaptation of the mask exaggerates the respiratory effort, especially in anesthesia for abdominal surgery.

VALUE OF VAPOR DEVICES.

While the wash-bottle used as an ether container serves routine purposes, the substitution of a Gwath-

mey or Lumbard vapor apparatus admits of far greater possibilities in vapor anesthesia and perfection in the technic of narcosis for special operative procedures. By means of such vapor devices the strength of ether delivered to the patient may be more accurately regulated and controlled. Chloroform may be added as required, or ascending and descending percentage mixtures of chloroform-ether utilized as indicated or desired. These devices also provide for warming and moistening the oxygenated anesthetic vapor when desired. As a general thing I do not advise the induction of anesthesia by this method unless by chloroform. The induction would be too prolonged. It is far better to induce anesthesia with gas-ether and then switch to the ether-oxygen vapor when patient is well under. Ethyl-chlorid may be similarly used for induction.

Regulating Anesthesia.

The flow of ether-oxygen for maintaing anesthesia depends, of course, on the individual reactions of various patients to anesthesia. There are

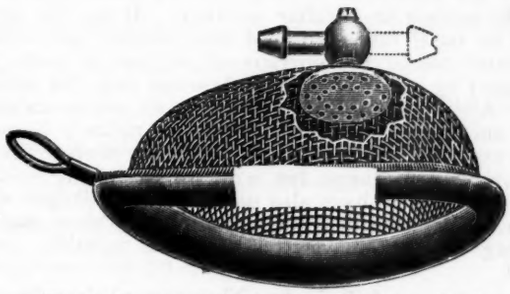

Fig. 1—Lumbard Mask for Vapor Anesthesia.

no hard and fast rules. The anesthetist must be guided by the signs and symptoms of anesthesia and the requirements of the operative procedure. Suffice to say that by regulating the flowing of the vapor anesthesia may be lightened or deepened with singular ease and facility.

This method of ether-oxygen vapor anesthesia may be used for nose and throat operations and for intrapharyngeal anesthesia for all purposes, including thoracic and intro-thoracic surgery. In this connection it is important to emphasize the fact that the transition from the mask to the gag or intrapharyngeal tube must not be made short of surgical narcosis. With this method and under proper control the lungs may be distended or allowed to collapse, periodically, as may be required, during intrathoracic operations.

Conclusions.

While my observations and the apparatus presented may seem very commonplace, I have dared to present them because of their simplicity and more especially because they fit in so admirably with the work of instructing interns in better and safer anesthesia. The method and apparatus may be used routinely because the latter is obtainable in all hospitals and because the former is adaptable to the routine surgical procedures in the largest general

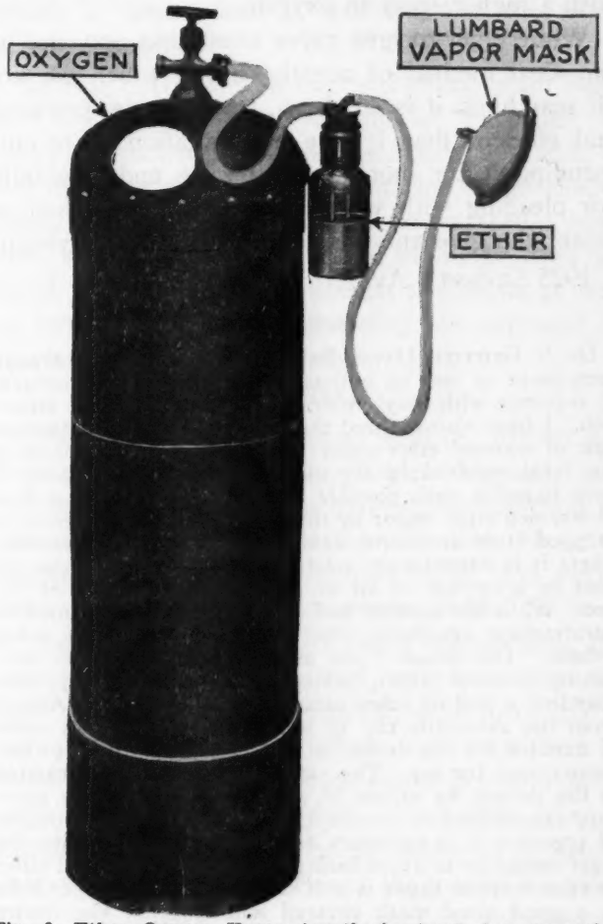

Fig. 2—Ether Oxygen Vapor Anesthesia Apparatus, connected to oxygen tank.

hospitals. The great advantage of ether-oxygen anesthesia over all other methods of anesthesia is the wide range of safety and extended field of usefulness. Patients recover from its effects in a very satisfactory condition. There is little headache, nauseau, vomiting or depression. While cost should never be considered where the safety of patients is concerned, still ether-oxygen anesthesia is an inexpensive method. The amount of ether used by this method averages from two to three ounces per hour. The extra cost of the oxygen is nearly offset by this economy in the use of ether. The amount of ether consumed is no more than that commonly used with the gas-oxygen ether sequence. The ether-oxygen provides any degree of relaxation without jeopardizing the patient's welfare or chances of recovery. It obviates the dangers of respiratory obstruction, circulatory decompensation, shock, acidosis and sepsis by promoting hyperoxygenation at a time when the entire bodily economy would suffer from the effects of deoxidation. So far as my experience goes this method has much to recommend it and nothing against it. Can the

same be said of other routine methods? I would like to go on record as predicting that the coming general anesthetic of choice for routine use will be some form of continuous, regulated ether-vapor with a high respect to oxygen.

While ether-oxygen vapor anesthesia may not be the ideal method of anesthesia for which we are all searching, it is so cheap, simple, safe, practical and efficient that I have no hesitation in recommending it for more extensive use and especially for pleading with you all to teach the method to those who give anesthetics under your supervision.

1925 SEVENTH AVE.

DISCUSSION.

DR. S. GRIFFITH DAVIS, Baltimore, Md.:—I have always been more or less an enthusiast about ether, particularly in sequence with ethyl chlorid or nitrous oxid for induction. I have also realized the advantages of a continuous flow of warmed ether-vapor for maintaining anesthesia at any level required by the operative procedure. Lately I have found it quite possible to provide a continuous flow of warmed ether vapor by the drop method. The ether is dropped from an oil-cup device, into a warming chamber, where it is immediately volatalized and carried to the patient by a current of air or oxygen or a mixture of the two. While the method and apparatus are not adapted to intratracheal anesthesia, they are suitable for any other technic. The device I am using now is a cylinder containing a water-jacket, heated by an electric lamp, surrounding a coil of tubes onto which the ether is dropped from the automatic cup to be vaporized. It takes some 15 minutes for the device to become heated to the proper temperature for use. The vaporized ether may be carried to the patient by means of a blower, bellows, low pressure oxygen tank or nitrous oxid tank. In using any degree of pressure it is necessary to divert part of it into the other container to avoid back pressure. The warmed ether or ether-oxygen vapor is sent through a short rubber tube to a good sized mask covered with gauze. The device may be used for oral and nasal methods of anesthesia with great facility and little manipulation; only the ether dropper and air or oxygen current requiring occasional regulation. The anesthetist is practically left care-free to act as an assistant to the operator.

DR. WM. B. HOWELL, Montreal, Canada::—How high may the temperature in the heater go without decomposing the ether. In using the Connell Anesthetometer I have found that if the heater is turned on for any length of time before the flow of ether is begun, that the ether is readily decomposed and formalin formed.

DR. S. GRIFFITH DAVIS:—Decomposition is apt to occur in any apparatus not dependent on a water-jacket for heating the ether vapor. Ether does not decompose short of the boiling point of water and in the device I have shown the electric lamp heating unit is so small that it cannot set the water in the jacket to boiling no matter how long it is kept turned on. Experiments have shown that ether vapor may be delivered to the patient with this device at about a temperature of 99°F.

DR. E. I. MCKESSON, Toledo, O.:—The heat required to decompose ether is something over 300°F. It goes almost without saying that oxygen should be used with every anesthetic. It should be remembered that cyanosis differs with ether and nitrous oxid. While there may be the element of limitation of oxygen present in each instance, with ether cynaosis there is depressed blood pressure, while with nitrous oxid cyanosis blood pressure is increased. Concomitant oxygenation is serviceable in those operative procedures in which the operator, on account of the necessary operative procedure induces suboxidation by closing the air way. In such cases thorough oxygenation conserves the oxidation requirements of the patient during the periods of embarrassed respiration. Oxygen is effective even in wet lung conditions.

DR. RAY A. RICE, Columbus, Ohio:—Having used oxygen with various anesthetics for a great number of years, I can quite agree with Dr. Lumbard's conclusions. Oxygen, probably shows at its best when used with ethyl chlorid, in which combination it entirely eliminates respiratory spasm, which is so prone to occur with ethyl chlorid alone or when diluted only with air. Concomitant oxygenation, also, always provides safer and more satisfactory relaxation. Personaly I now prefer the use of ether-oxygen by a method of rebreathing. The ether vapor is provided by a flow of oxygen through a Gwathmey three-bottle vaporizer, where it is warmed and moistened in the hot-water bottle, and thence passes into a rubber tube attached to a Coburn pharyngeal tube fitted with a rebreathing bag. After the induction of ether by the ethyl chlorid-ether or nitrous oxid-oxygen-ether sequence, the pharyngeal tube is introduced and the device stabilized on the patient's face by means of a forehead rest held in place with adhesive. The ether-oxygen vapor is then turned on and administered with whatever degree of rebreathing is desired or required. As the Gwathmey device also provides chloroform it may be added to the mixture in recalcitrant subjects, when the operator demands profound relaxation and abolition of almost all the reflexes. Previous to my service, lately, at the Walter Reed Hospital, Washington, D. C., the drop-ether inductions had required from 15 to 20 minutes. The preliminary use of ethyl chlorid, at my suggestion, cut down the induction period to less than 5 minutes. Ether-oxygen warmed vapor is peculiarly serviceable for anesthesia in long, difficult neural operations, with the patient in peculiar positions. It can be administered by nasal tubes strapped into position and with the anesthetist out of the operative field, but in touch with the patient by means of the stethoscope over the patient's heart. Also it lends itself admirably to use in extensive plastic surgery of the face and jaw in military hospitals. I have used the Lumbard vapor mask, for some years, but not covered with gauze, but with its mesh wire soldered into a solid top. I have also used the ether-oxygen vapor with a mask, provided with expiratory valves and rebreathing bag and have found this a valuable routine method.

DR. LUMBARD, (Closing):—The ground has been so thoroughly covered that I have nothing more to add.

THE ATTENTION OF ANESTHETISTS IS ESPECIALLY DRAWN TO DR. MILLER'S PAPER IN THE CURRENT ISSUE OF THE SUPPLEMENT. IT IS ANOTHER EVIDENCE OF THE INTERESTING MATERIAL THAT MAY BE DEVELOPED FROM ANESTHETIC RECORDS IF THEY ARE KEPT WITH SOME DEFINITE PURPOSE IN MIND. DR. MILLER HAS MADE HIS RECORDS SHOW SOME INTERESTING AND VALUABLE THINGS IN RESPECT TO BLOOD PRESSURE AND ALSO AGE IN SURGICAL PROGNOSIS.

IT IS OF INTEREST TO NOTE THAT ONE OF THE FIRST ACTIONS TAKEN BY THE RECENTLY ORGANIZED TOLEDO SOCIETY OF ANESTHETISTS WAS THE ADOPTION OF A UNIFORM ANESTHETIC RECORD TO BE USED BY ALL THE MEMBERS IN THEIR HOSPITAL AND PRIVATE WORK. IN THIS WAY RECORDS WILL ACCUMULATE VERY RAPIDLY AND SERIES OF 1,000 ADMINISTRATIONS AND RESULTS MAY BE FREQUENTLY STUDIED IN THE LIGHT OF NEWER PROBLEMS PRESENTING FOR SOLUTION.

IT WILL HELP THE SPECIALTY FOR OTHER ORGANIZATIONS TO FOLLOW THE EXAMPLE SET.

OBSERVATIONS ON INTRATRACHEAL ANESTHESIA IN NEUROLOGIC SURGERY.*

A. W. ADSON, M.D.
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Intratracheal anesthesia has a definite, but limited field of usefulness. Only a short time ago its use was advocated in operations on the oral cavity, tongue, larynx, chest, and brain, but a comparison of the inhalation drop method, with intrapharyneal and the intratracheal method, has resulted in the gradual abandonment of the latter except in an occasional chest operation, and in operations on the cerebellum, pons, and medulla.

Numerous observations have been made in neurologic surgical cases during convalescence. Only a few years ago, the mortality following such operations was very high, owing to faulty technic and improper anesthesia. It was not unusual for the patient to remain unconscious for from two to twelve hours after the operation. Three obvious factors are responsible for this:

1. The anesthetist did not take into consideration the effect of the concussion produced by the operative procedure on the cranium.

2. The effects of morphin administration, which disguises the exact stage of the anesthesia.

3. The improper administration of ether, due to the cramped position of the head and neck in operations on the cerebellum, pons, medulla, and cervical spinal cord.

The inhalation drop method of administering ether is superior to the intratracheal method in operations in which the head is permitted to lie on the occiput or on one side. The procedure is simple, is just as efficient as any other, and is not attended with any bronchial complication.

The amount of ether necessary for an intracranial operation is less than that required for an intra-abdominal operation of the same duration, because of the concussion which is produced in the manipulations to turn an osteoplastic flap, or to produce a decompression. The same point is emphasized in the fact that a skull fracture can be treated with the patient in a semiconscious state, without an anesthetic, and that a craniotomy can be done under a local anesthetic.

Morphin only adds to the narcotic state and, with the concussion, produces an unconscious state which is deeper than is indicated by the usual signs of anesthesia.

During operations on the cerebellum, brain stem, and cervical cord, the surgeon is compelled to place the patient in a prone position; this adds to the difficulty of ether administration, and changes have, therefore, been made in the cerebellar head rest, which will secure the head in any position desired, and will permit inhalation anesthesia as well as intratracheal anesthesia during the exposure of the cerebullum or brain stem.

TECHNIC.

The anesthetic is not begun until the patient has been placed on the operating table. The only preoperative preparation is a hypodermic injection of atropin. After the patient is anesthetized, the head is placed in position and benzin, iodin, and sterile linen are applied to the operative field. As soon as the operative procedures reach the cranium, the amount of ether is diminished until the patient begins to move. The anesthetist, therefore, has a new anesthetic level to follow, and must bear in mind the effects of the concussion in conjunction with the effects of the ether. Very little ether is necessary, in fact, it can be administered so lightly that, when the wound is closed, the patient is awake. It is well to have the patient soundly anesthetized before the intratracheal tube is inserted. The method of inserting the tube has been described by Robinson[1]; the machine used was designed by the writer and Little[2]. It consists of an ether chamber connected with a blower, which has a three-way valve, so the patient can get pure air or any degree of ether saturation that is desired. The safety valve is connected with a mercury manometer, which controls the intratracheal pressure. The administration of ether is controlled by a valve which the anesthetist manipulates to secure the desired amount of ether saturation.

Deep anesthesia should be avoided in neurologic operations, and intratracheal anesthesia should be resorted to only when respiratory difficulties due to the operative manipulations are feared.

MAYO CLINIC

REFERENCES

[1]Robinson, S.; Intratracheal ether anesthesia—a new apparatus and intratracheal tube. Surg., Gynec., and Obst., 1915, xxi, 774.

[2]Adson, A. W. and Little, G. G.: Intratracheal anesthetic machine. Jour. Am. Med. Assn., 1918, lxx, 1746-1747.

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OCTOBER EDITORIALS. 1919

POSTOPERATIVE ANALGESIA.

Writing in the *Boston Medical and Surgical Journal,* May 15, 1919, and speaking later before the Joint Meeting of the Interstate Anesthetists and the American Association of Gynecologists and Obstetricians, at Cincinnati, September 15, Dr. Bertha Van Hoosen, of Chicago, has drawn renewed attention to the importance of postoperative analgesia. She contends that:

"It would seem at times as though the surgeon, the obstetrician, and even the family physician regards the relief of pain more as a means of facilitating his work rather than a method by which to preserve the strength and increase the recuperative power of the patient.

The surgeon insists upon a profound anesthesia for the operation, which is only ten to thirty minutes in length, but leaves no orders for the relief of postoperative pain; or, if he gives such an order, it is not carried out until the patient is exhausted and crazed with the pain, and the relief is only for a short time.

The obstetrician leaves the patient to suffer for many hours without even the support of his presence, and at last at the close of labor gives an anesthetic for from five to thirty minutes.

Even the family physician is warned against giving morphin lest he may obscure the diagnosis, or lead the patient into a narcotic habit.

Lessened mortality has been, up to the present day, the first aim of the medical man, and lessened morbidity the last. That morbidity and mortality are twin sisters is to be demonstrated by the physicians of the future.

We have a few already pointing the way. Most prominent among these is Dr. George Crile of Cleveland, who has taught us that pain and anxiety as also thirst and insomnia, can do irremediable damage to the brain. Professor Kronig has brought to the field of obstetrics that much abused term "Twilight Sleep," which has proved such a boon to the modern mother. So successful has it been that delicate women have been kept free from pain for one or two days, and by its use the exhausting effects of a long and tedious labor have been avoided and the patient wakens with a sense of well-being and of having had a refreshing sleep.

Hoping to obtain for postoperative patients a condition similar to the obstetrical twilight sleep of Kronig and Gauss, 452 patients were given the following routine treatment after operation: $^1/_{32}$ of morphin and $^1/_{200}$ of scopolamin every four hours by hypodermic injection for 24, 36, and in very painful cases, 48 hours after operation.

The hours chosen for the administration of the postoperative scopolamin and morphin were twelve, four, and eight A.M. and P.M. Where a number of patients were receiving this treatment it facilitated the work of the nurse to have the doses for all of the patients at the same hour. As patients slept more soundly just after the hypodermic injection and were more wakeful the hours preceding, these special hours mentioned above were found to be advantageous, for it left the patient sleeping during the serving of dinner and supper and during the hours for morning hard work, and awake during visiting hours, between 2 and 4, and 7 and 8 P.M.

The following report of 452 patients was compiled by my assistant, Dr. Martha Welpton, from the records of the patients in the Mary Thompson and Cook County Hospitals during the year 1916:

Under "Sleep" the cases are listed as slept well, fairly well, or poor. The first and second nights are giving separately.

"Pain,"—anything which might cause patient to complain, as gas, headache, wound, etc. "Emesis" covers any nausea or vomiting during the first two

MARY THOMPSON HOSPITAL

No. of Patients		Sleep: Poor	Sleep: Fair	Sleep: Well	Pain	Emesis	Respiration	Pulse
200	1st night	28 (14%)	107 (53.5%)	65 (32%)	46 (23%)	77 (38.5%)	62 (31%)	99 (45.5%)
	2nd night	15 (8%)	82 (41%)	101 (50.5%)				

COOK COUNTY HOSPITAL

No. of Patients		Sleep: Poor	Sleep: Fair	Sleep: Well	Pain	Emesis	Respiration	Pulse
252	1st night	40 (15.4%)	106 (42.6%)	108 (42.6%)	33 (13%)	93 (37%)	4 (1.5%)	136 (53.9%)
	2nd night	20 (7.7%)	87 (34.5%)	145 (57.8%)				

days, even though it were but a mouthful, and but once.

"Respiration" shows a record of respiration under sixteen during the first twenty-four hours. None was found during the second twenty-four hours.

"Pulse" shows record of pulse above 100 during the first twenty-four hours.

MARY THOMPSON HOSPITAL.

Two hundred consecutive cases operated and given postoperative doses of morphin $^1/_{32}$, scopolamin $^1/_{200}$, for from twelve to forty-eight hours. Thirty-six hours, or until midnight of the second day, was the usual time.

COOK COUNTY HOSPITAL.

Two hundred and fifty-two consecutive cases operated and given postoperative doses of morphin $^1/_{32}$, scopolamin $^1/_{400}$, for from twelve to forty-eight hours. Thirty-six hours, or until midnight of the second day, was the usual time.

Patients at the County Hospital were given the postoperative dose of scopolamin $^1/_{200}$ and morphin $^1/_{32}$, but it was soon discontinued and scopolamin $^1/_{400}$ was substituted for the $^1/_{200}$ on account of the patient occasionally getting out of bed or showing signs of mild delirium, and thereby requiring extra attention from the nurses.

These reports, although very satisfactory, do not begin to compare with the verbal reports given by patients themselves just before leaving the hospital. For the benefit of the post-graduate visitors it has been customary to interrogate patients as to whether they had any nausea or vomiting, and as to the amount and severity of pain following operations. It is often surprising to receive a denial of any stomach disturbance or any pain whatever since the operation, but on referring to the charts, there would be found a record of vomiting or complaint of gas pains or an enema for gas pains. On questioning the patient more closely as to details of happenings during the first two days following operation it became evident that the patient had not only marked and prolonged analgesia but also some amnesia.

Postoperative analgesia is most beneficial to patient and nurse alike. To the patient because it shortens convalescence and leaves no dread of future operations. To the nurse because it enables her to care for her patient as she cares for a healthy infant, there being no necessity for giving moral support or enforcing discipline, and the nurse may sit and read or doze for many hours during the day and pass her nights with comparatively little disturbance. In fact, when a patient is not able to afford a special nurse for more than two or three days, if postoperative analgesia is employed, the patient is advised to have the special nurse the last few days in the hospital, when attractive trays and getting out of bed several times a day add so much to the patient's comfort."

Newer Apparatus

Editor's Note: From time to time this Department will publish Illustrations and Technical Details of the Newer Apparatus for Anesthesia and Analgesia.

AN APPARATUS FOR PHARYNGEAL NITROUS OXID-OXYGEN ANESTHESIA.*

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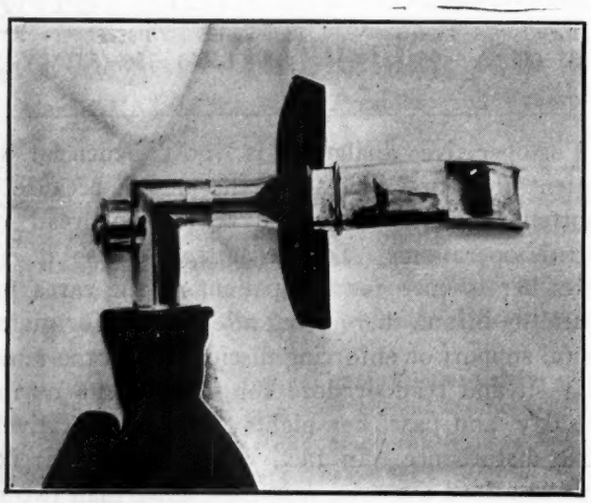
Satisfactory nitrous oxid-oxygen anesthesia depends largely on the proper apparatus and the most important item in this is an arrangement to maintain an air-tight joint over the air passages and have perfect control of the air (or oxygen) in the aesthetic mixture.

No perfect device has been suggested yet, but in the dossal position any of the ordinary face pieces may be made to fit satisfactorily after proper adjustment. However, in operations in the prone position, in operations on the head, face or neck, and in prolonged operations which tax the patience of the anesthetist in keeping the face piece accurately in place, the apparatus devised for use at

*This device was made for the author and used by him with success while working at General Hospital No. 1, U. S. Army. Authorized for publication by the Surgeon General's Office.

U. S. Army General Hospital, No. 1, and shown in the accompanying photographs has proved completely satisfactory during a prolonged experience with it.



The apparatus consists of a pharyngeal breathing tube, to which is attached by a slip joint a right angled hollow tubing of sufficient length to extend beyond the nose, with an expiratory valve located just beyond the angle. Exclusion of the outside air is effected by the rubber cuff fitting the tube closely and laid between the gums and cheeks, and by plugs of cotton in the nostrils.

The induction is carried through to complete anesthesia with the ordinary face pieces. When the pharyngeal reflexes are dulled, the pharyngeal tube is inserted, the rubber cuff set in place in the mouth and the nostrils plugged; thereafter the anesthetist has no worry over an obstructed air way and has simply to regulate the gases to suit the operative condition.

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Abstracts

A Résumé of the International Current Literature of Anesthesia and Analgesia

Subconjunctival Injection of Cocain for Cataract and Glaucoma Operations. J. SANTOS FERNANDEZ and F. M. FERNANDEZ. *Cronica Medico-Quirurgica,* Havana, February, 1919.

Santos Fernandez says that these operations can be done without subconjunctival injection of cocain, but if one wishes to omit nothing that will aid in rendering the operation a success, this is certainly to be recommended. He injects 0.005 gm. of morphin half an hour before the operation and repeats it after the operation, as it is very important to keep the patient in a tranquil frame of mind. To aid in this he does not set a day for the operation, but keeps speaking of preliminary things that have to be done, and the operation can then be performed whenever most convenient and without apprehension on the patient's part.

Spinal Anesthesia. H. P. ACHARD. *Progrès Medical,* Paris, June 21, 1919.

Achard states that he has applied stovain low rachianesthesia in 123 cases and procain anesthesia in 290—thus well over the 400 mark. There were no fatal accidents and no durable injury in any case, but some disturbances developed within an hour or during the three following days in a few. Analysis of these cases demonstrates, he says, that the only failures were due to defective technic, and with greater experience they grew less frequent. The only mishaps were transient headache indicating slight irritation of the meninges. This was noted in 10 per cent. of the procain cases and in 50 per cent .of the stovain cases. The few cases in which an English make of procain was used all developed headache or pain in the spine; in two cases the latter kept up for five days. Postoperative vomiting and nausea for a few minutes were noted in 10 per cent. of all the cases, and a tendency to brief syncope was evident in 4 per cent. of the procain and in 10 per cent. of the stovain cases. Incontinence of the sphincters is annoying. It occurred in 50 per cent. of stovain cases but less frequent with the procain. The operations were all below the umbilicus and no attempt was made to have high anesthesia.

Conductive Anesthesia by Intrasacral Extradural Injection of Procain. S. A. MEAKER. *British Medical Journal,* May 10, 1919.

The method described by Meaker is said to be a new one. When procain is injected extradurally into the bony canal of the sacrum, anesthesia of the third and lower sacral and coccygeal nerves is produced. The motor roots are not affected, and retention of urine after hemorrhoid operations done with sacral injections is neither more nor less common than when a general anesthetic is given. The regions supplied by the first and second posterior sacral nerves may undergo a paresthesia, but they are not anesthetized. The field of usefulness for sacral anesthesia is said to comprise operations for hemorrhoids, fistula and other conditions in and about the anus. In some cases the anesthesia is limited to a circle around the anus 3 or 4 inches in radius, while in others almost the whole of the buttocks may be analgesic. There is usually bilateral symmetry of effect. The lower rectum is anesthetized for at least 3 inches above the anus. The injection is to be made through the approximate center of the sacral hiatus.

Circulation in Shock After Abdominal Injuries. J. ERLANGER, R. GESELL and H. S. GASSER, St. Louis. *American Journal of Physiology,* Baltimore, June 1, 1919.

In an investigation made by Erlanger, Gesell and Gasser the changes in circulation occurring during the development of shock brought on by exposure and manipulation

of the tubes are as follows: The arterial pressure at first may be lowered but little, if any. After some time, it may be after some hours, the pressure begins to fall, and this fall continues more or less steadily, though often slowly, until the animal dies. The changes occurring in the systemic venous pressure have been so small that they cannot be regarded as significant, excepting, perhaps in demonstrating that cardiac failure has little, if anything, to do with the failure of the circulation. The portal venous pressure falls continuously, though slowly, during the first two or three hours. It then ceases to fall or actually rises slightly until the arterial pressure has reached a comparatively low level, when the portal pressure again begins to decline. The peripheral resistance, both somatic and splanchnic, at first practically invariably is increased. At about the time the arterial pressure begins to fall, or starts on its steady decline, and also at about the time the portal pressure starts to rise, the peripheral resistance begins to diminish and by the time the arterial pressure has reached the vicinity of 50 mm. Hg, the peripheral resistance practically invariably is below normal. But up to the time of death the vessels and the vasomotor center preserve some residual tone, though slight reactivity. In this respect the findings of Bartlett are completely confirmed. A considerable loss of fluid from the exposed bowel occurs as a result of transudation through the serous surface, and presumably into the tissues also. The capillaries and veins of the intestinal villi are greatly distended and tightly packed with red corpuscles. No positive evidence has been obtained that the efficiency of the heart is impaired during the development of shock. Nevertheless, although the heart is capable of raising the arterial pressure as high as the normal heart can, the authors are inclined to believe that the heart in shock cannot maintain high pressures as long as the normal heart can. The initial changes in the circulation can be explained best on the assumption that the effective blood volume is reduced. The loss of fluid into and through the tissues of the bowel and the sequestration of blood in the intestinal capillaries and venules suggest a mechanism through which a reduction in blood volume might occur.

Local Anesthesia of Uterus. Prof. Ando. *Japan Medical World,* Tokyo, July 6, 1919.

By means of the vaginoscope the orifice of the uterus is exposed and the anesthetics are injected with a 5 gram syringe at posterior, anterior and bilateral points along the border of the cervix and the vaginal wall. The needle is driven toward the base of the cavity for a distance of 2 mm. and the injection is made very slowly. The operation is begun in about five minutes after the injection. By this method all the operations on the mucous membrane of the vagina and the uterine cavity may be carried out without applying general anesthesia.

Effect of Cocain Hydrochlorid on CO_2 Production. S. Niwa, Chicago. *Journal Pharmacology and Experimental Therapeutics,* Baltimore, January, 1919.

The results of Niwa's experiments support the statement that the local anesthestics, cocain hydrochlorid, affects the metabolism of the mixed nerve in exactly the same manner as do general anesthetics, namely, primary stimulation by a weaker concentration, and subsequent diminution of the CO_2 production by a higher concentration. These facts demonstrate that there is a close relationship between the rate of nerve metabolism and the state of excitability of the nerve, and suggest that anesthesia in general is probably brought about by interference with the tissue metabolism.

Action of Local Anesthetics on Striated Muscle. S. Kubota and D. I. Macht, Baltimore. *Journal Pharmacology and Experimental Medicine,* Baltimore, April, 1919.

The action of a large number of local anesthetics on excised skeletal muscles of the frog and the rat was studied by Kubota and Macht. It was found that all of the substances studied depressed the excitability and the contractility of striated muscle and caused a quicker onset of fatigue. No primary stimulating effect was noted after the exhibition of even very small doses of cocain or local anesthetics. Of the decomposition products of cocain, ecgonin was found to be a powerful depressant, while benzoyal ecgonin was only very slightly depressant in its action, and sodium benzoate and methyl alcohol produced practically no effect. The stimulating effect of cocain on muscular work, therefore, cannot be due to its peripheral action on the muscles themselves, but must be ascribed to a central action.

Traumatic Shock. E. Quenu. *Revue de Chirurgie,* Paris, September-December, 1918.

Quénu refers to the traumatic toxemia with its set of symptoms indicating depression of the vital processes while the mind is not impaired. He devotes 236 pages to analysis of the literature on the subject published by the Allies, thus compiling for future investigators the data on the subject accumulated during the war. The number of clinical observations published was comparatively small, but they brought about the revolution in the conception and treatment of shock. In the surgical posts at the front, traumatic shock sometimes was responsible for the death of more than half of those that could not be moved. He adds that when for special reasons it is impossible to remove the focus, instead of mere expectancy, we might temporarily fasten the toxins in situ, as Heitz-Boyer did in one case in intense traumatic shock, filling the largest of the three large wounds with a solution of formaldehyde and methylene blue and giving copious hypochlorite irrigation.

Locrimal Gland in Surgical Anesthesia. L. T. Rutherford. *Lancet,* London, May 10, 1919.

The secretory activity of the lacrimal glands is regarded by Rutherford as a valuable sign in guiding the administration of anesthetics. If the anesthetic is administered in quantities just calculated to abolish the lacrimal secretion, and then wait, if at any time in doubt, until the secretion again appears, Rutherford feels confident that he is well on the safe side of the border-line between deep surgical anesthesia and an overdose. The exhibition of such drugs as morphin, scopolamin and atropin in a large number of cases completely abolishes the lacrimal secretion. In the course of the investigations undertaken to establish the reliability of the lacrimal activity as a means of regulating the amount of the narcotic employed, over 200 cases were anesthetized for operations varying in severity from the opening of a superficial abscess to the resection of several inches of intestine. When chloroform is administered alone the quantity of the lacrimal secretion is usually small, but in uncomplicated cases it is at once evident. During the administration of ether the lacrimal secretion is abundant, and in giving mixtures containing ether the secretion does not fall much below that when ether is given alone. Rutherford insists that the appearance of a lacrimal secretion during anesthesia is a constant phenomenon; it bears a definite relation to the depth of narcosis; and, since the exceptions to the general rule are easily recognized, the value of this sign must be at once apparent.

Spinal Anesthesia. V. Riche. *Presse Medicale,* Paris, April 28, 1919.

Riche says that he has applied general rachianesthesia *par la voie lombaire* in 60 cases out of a thousand in which he has used ordinary spinal anesthesia. The latter permits all operations under the diaphragm, but with a modified Jonnesco and Le Filliatre technic he performed operations on the neck, chest and arms. In 3 of the cases there was a tendency to partial narcosis, but most of the time the patients were able to converse with the nurse in charge. In 30 per cent. of the cases there was transient retching from twenty to thirty minutes after the injection. With his modified technic, the dose of procain (novocaine) was 1 cg. per 5 kg. of the body weight. The puncture is made in the first or second lumbar interspace, the patient lying on his side, withdrawing 10 or 15 c.c. of

the spinal fluid. Then the anesthetic in an 8 per cent. solution is very slowly injected. He never uses epinephrin with it, but in the course of the injection he draws some of the spinal fluid up into the syringe several times to mix it well with the anesthetic. He declares that this technic can compete on an equal footing with general anesthesia and blocking the trunk nerve, but local anesthesia is preferable to all other technics when conditions permit it.

Tremor During General Anesthesia. T. REITZ. *Hygiea,* Stockholm, April 15, 1919.

Rietz noticed in 28 cases the development of a tremor during general anesthesia which resembled in character and course the rhythmic phenomena observed at times with irritation of motor tracts. His study of its mechanism revealed a means to control it, namely, by shutting off partially from the brain the blood laden with the anesthetic. This he accomplished by pressure on the carotid artery. The tremor ceased at once in 16 of the 25 cases in which this was done and it became much reduced in 4 others, but no effect was apparent in the 5 others.

Operations on Diabetics. L. BLUM. *Paris Medical,* May 3, 1919.

Blum distinguishes between the surgical affections which are quite independent of the diabetes and those connected with the disease. The general rules of surgery apply to the former, but with the lesions determined by the diabetes or connected with it, preliminary dietetic treatment is imperative. In the milder forms of diabetes, the results can be only favorable. In the graver cases, energetic dietetic treatment should be given for forty-eight hours at most, carbohydrates one day, fasting the next. Then the operation should be done without further delay if it is deemed wise to attempt it at all. It has been his experience that surgical complications set up a vicious circle in diabetes. His experiments and clinical research have shown further that chloroform is especially harmful and should never be used for diabetics. Diabetic coma after ether is also not infrequent, although many surgeons have performed successful operations under ether. Local and spinal anesthesia would be preferable if it were not for the emotional shock of the intervention which counterbalances the advantages of abstention from general anesthesia. Sodium bicarbonate should be given by the mouth or vein as long as the danger of coma persists.

Subcutaneous Ether-Oil Anesthesia for Guinea-Pigs. J. T. GWATHMEY. *New York Medical Journal,* July 19, 1919.

Many animals during the war were required in both medicine and surgery in the effort to conserve the life of the soldier. The blood of guinea-pigs and rabbits was used extensively in the production of reagents for the Wassermann reaction, and the blood of rabbits was used in the production of diagnostic serum. Dogs and cats aid in the decision of many problems concerning the badly wounded soldiers, such as shock, or the choice of one of several operations. It is desirable to anesthetize these animals in the most humane, the simplest, quickest and safest way. These requirements have been met by the subcutaneous injection of ether and oil. After various modifications, the technic, as finally employed, consisted in giving the injection just back of the neck, against the direction of the hairs, which are not removed. The following doses have been determined for guinea-pigs: For each 100 gm. of body weight, 85 per cent. ether with 15 per cent. olive oil was the mixture used in the experiments. Maximum safe dose—anesthesia of one to two hours: 0.74 c.c. of ether, or 0.87 c.c. of 85 per cent. ether and 15 per cent. of oil mixture (or 1.00 c.c. of 75 per cent. ether and 25 per cent. oil mixture). Medium dose—anesthesia for about one hour: 0.55 c.c. of ether, or 0.65 c.c. of 85 per cent. and 15 per cent. oil mixture (or 0.72 c.c. of 75 per cent. ether and 25 per cent. oil mixture). Minimum practical dose—anesthesia of about thirty minutes: 0.46 c.c. of ether, or 0.54 c.c. of 85 per cent. ether and 15 per cent. oil mixture (or 0.60 c.c. of 75 per cent. ether and 25 per cent. oil mixture).

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ANESTHESIA, GENERAL, TREMOR DURING. T. Rietz. Hygiea, Stockholm. April 15, 1919.

ANESTHESIA, MODERN SURGICAL, FIRST PRINTED DOCUMENTS RELATING TO. Wm. Osler, Oxford, England. Annals of Medical History, December, 1918.

ANESTHESIA, SURGICAL, ROLE OF LACRIMAL GLAND SECRETION IN. L. T. Rutherford. Lancet, May 19, 1919.

ANESTHESIA FOR OPTHALMIC OPERATIONS. C. T. W. Hirsch. Lancet, June 21, 1919.

ANESTHETIST, ROLE OF THE, ON THE SURGICAL TEAM. John J. Buettner, Syracuse, N. Y. New York State Journal of Medicine, May, 1919.

ANESTHETICS IN BRITISH HOSPITALS WITH THE SERBIAN ARMY. J. P. Good. British Medical Journal, May 31, 1919.

CHLOROFORM ANESTESIA, INFLUENCE OF FASTING AND VARIOUS DIETS ON LIVER INJURY, EFFECTED BY. H. C. Davis and G. H. Whipple, San Francisco. Archives of Internal Medicine, May 15, 1919.

CHLOROFORM ANESTHESIA, INFLUENCE OF DRUGS AND CHEMICAL AGENTS ON LIVER NECROSIS. N. C. Davis and G. H. Whipple, San Francisco. Archives Internal Medicine, May 15, 1919.

COCAIN HYDROCHLORID, EFFECTS OF ON CARBON DIOXID PRODUCTION OF MIXED NERVE FIBER. S. Niwa, Chicago. Journal of Pharmacology and Experimental Therapeutics, January, 1919.

COCAIN, SUBCONJUNCTIVAL INJECTION OF, FOR CATARACT AND GLAUCOMA OPERATIONS. J. Santos Fernandez. Cronica Medico Quirurgia, Havana, February, 1919.

DIABETES, OPERATIONS, IN, INDICATIONS FOR (ANESTHESIA). L. Blum. Paris Medical, May 3, 1919.

ETHER-OIL RECTAL ANESTHESIA. J. C. Clayton. Lancet, May 19, 1919.

ETHER-OIL SUBCUTANEOUS ANESTHESIA FOR GUINEA PIGS. J. T. Gwathmey, New York City. New York Medical Journal, July 19, 1919.

ETHER, OPEN METHOD, MODIFICATION OF. J. F. W. Silk, London. British Medical Journal, May 24, 1919.

ETHYL CHLORID GENERAL ANESTHESIA IN WAR SURGERY. L. Caforio. Riforma Medica, Naples, April 19, 1919.

LOCAL ANESTHESIA, TONSILLECTOMY UNDER. G. B. Johnson, Franklin, Pa. Pennsylvania Medical Journal, February, 1919.

LOCAL ANESTHESIA OF THE UTERUS. Prof. Cardo. Japan Medical World, Tokyo, July 13, 1919.

LOCAL ANESTHETICS, ACTION OF, ON STRIATED MUSCLE. S. Kubota and D. I. Macht, Baltimore. Journal of Pharmacology and Experimental Therapeutics, April, 1919.

NITROUS OXID ANESTHESIA IN CAESEREAN SECTION AND OPERATIVE OBSTETRICS. E. I. McKesson, Toledo. Ohio State Medical Journal, July, 1919.

SACRAL ANESTHESIA BY THE INTRASACRAL, EXTRADURAL INJECTION OF PROCAIN. S. A. Meaker. British Medical Journal, May 10, 1919.

SACRAL ANESTHESIA: ITS VALUE. P. Syms, New York City. Medical Record, June 14, 1919.

SPINAL ANESTHESIA. F. Herrer. Plus Ultra, Madrid. December, 1918.

SPINAL GENERAL ANESTHESIA. V. Riche. Presse Medicale, Paris, April 28, 1919.

SPINAL ANESTHESIA, ELIMINATION OF PROCAIN AFTER. H. P. Achard. Progress Medicale, February 15, 1919.

SPINAL ANESTHESIA IN UPPER ABDOMINAL SURGERY. L. L. Stanley, St. Quentin. California State Journal of Medicine.

SPINAL ANESTHESIA. H. P. Achard. Progress Medicale, Paris, June 21, 1919.